Report of

REAPPRAISAL OF DIRECT AGRICULTURAL BENEFITS AND PROJECT IMPACTS

VERNAL UNIT
CENTRAL UTAH PROJECT
COLORADO RIVER STORAGE PROJECT

U. S. DEPARTMENT of AGRICULTURE
Salt Lake City, Utah - November, 1956

APRIL 1957

UNITED STATES DEPARTMENT OF AGRICULTURE

REPORT OF

REAPPRAISAL OF DIRECT AGRICULTURAL

BENEFITS & PROJECT IMPACTS

VERNAL UNIT

CENTRAL UTAH PROJECT

COLORADO RIVER STORAGE PROJECT

COOPERATING AGENCIES

Soil Conservation Service
Agricultural Research Service
Forest Service
Farmers Home Administration
Agricultural Stabilization & Conservation
Utah Agricultural Experiment Station
Utah Cooperative Extension Service
State of Utah

In Coordination With
Bureau of Reclamation
United States Department of the Interior

REPORT PREPARED BY

USDA FIELD ADVISORY COMMITTEE & USDA FIELD PARTY

Salt Lake City, Utah - November 1956
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SUMMARY OF REPORT ON

REAPPRAISAL OF DIRECT AGRICULTURAL BENEFITS & PROJECT IMPACTS

Vernal Unit - Central Utah Project

General Description

The Vernal unit of the Central Utah Project is located on Ashley Creek--a tributary of the Green River--in Uintah County, northeastern Utah. Lands in the unit area range in elevation from 4,700 feet to 5,700 feet. The climate is arid with an average annual precipitation of 8.5 inches and an average frost-free season of 119 days. Irrigation is essential to successful crop production and has been practiced since 1873. General farming is the major industry of the unit area.

Evaluation of Expected Direct Agricultural Benefits

Procedures and Sources of Information

This report is based on available field data, published reports, and the combined judgment of agricultural technicians familiar with the unit area, its agricultural problems, and conditions.

Preliminary reports, land classification maps and field sheets, farm schedules, and other data collected by the Bureau of Reclamation were made available and have been used to acquaint technicians with present conditions and proposed developments.

As limited time would permit, soil surveys, field investigations, engineering surveys, crop yield determinations, and irrigation water investigations were made by members of the Department of Agriculture Field Party and by local representatives of the Forest Service, Soil Conservation Service, Agricultural Research Service, and Bureau of Reclamation. These studies were made in portions of the unit area where available information did not give an adequate sample. In addition, assistance from representatives of the Utah Cooperative Extension Service, Utah Agricultural Experiment Station, Utah State Forester, Utah Water and Power Board, Farmers Home Administration, Agricultural Stabilization and Conservation Committees, Bureau of Land Management, Bureau of Indian Affairs, and others have been valuable in preparing the report.

Soils

The Soil Conservation Service, cooperating with the Uintah Basin Soil Conservation District, has supplied detailed soil survey information for the Vernal unit area. Useful references used in this survey include Bureau of Reclamation Land Classification Field Sheets and the Soil Survey Report of Ashley Valley. Detailed farm surveys on 9,624 acres were available but an additional 1,200 acres were surveyed to insure adequate consideration of all soil types and land conditions throughout the unit area. The total of 10,824 acres surveyed represents a 28 percent sample of the 38,439 acres, which is the total acreage of the Vernal unit area.

From this detailed soil survey sample, soils were grouped according to the USDA Land Capability Classes. The acreages of these land capability classes were then compared with acreages in the Bureau of Reclamation land classes.

Based on this comparison, it is concluded that:

The 14,114 acres for which the Bureau of Reclamation plans to supply additional irrigation water are suitable for long-continued cultivation under irrigation.

Classes II and III include an additional 13,310 acres which have correctable limitations. The majority of this acreage is affected by water table alone or in combination with salinity and uneven topography. In addition, a small acreage is affected by limitations of stoniness and alkalinity. With these limitations removed and irrigation water available, these lands would be suitable for continuous cultivation under average management. Additional investigations would determine treatment and management required for development.

There are approximately 1,744 acres of land suitable for irrigated pasture and occasional cultivation with proper land treatment if additional irrigation water were made available.

Land Improvement

Present ditch systems and land preparation for irrigation are much below the standard which will enable farmers to use water most efficiently, obtain high crop yields, and obtain maximum benefits from the improved water supply which the unit will make available. The economic analysis of anticipated returns for this unit has been based largely on increased crop yields expected with the improved water supply. No allowance has been made for increased crop yields which might be obtained, except for minor improvements in present irrigation practices.

The financial advantages of improvements in land and more efficient water management on the farm have been so well demonstrated in other similar locations that this report would be incomplete without mentioning them.

The cost of irrigation improvements, which would raise the unit area land to a high practical level of productivity, will average from about $75 per acre for Class 1 land to about $100 per acre for Class 3 land.

Irrigation Requirements

Sufficient basic data regarding irrigation requirements in the Vernal unit are available from past detailed studies by the Utah State Agricultural College, Utah State Engineer, and the United States Department of Agriculture. No additional field work on this subject was necessary.

During spring snowmelt Ashley Creek usually carries more water than is needed at that time for the irrigated lands in the valley. Later in the summer stream flow is usually much below the irrigation demand. This condition has led to excessive irrigation in the spring in an ineffective effort to store water in the soil for use late in the season. Irrigation water from canals, which do not have a full season water supply, is customarily over applied to all crops in the early months and in later months, primarily to the corn crop. This practice has caused alfalfa and irrigated pastures to suffer from the lack of water.

Some of the irrigation companies have old water rights and enjoy virtually a full year-long water supply while most irrigation companies have varying degrees of water shortage nearly every year. This makes the use of past diversion records valueless in studying the amount of water actually needed to produce high crop yields.

In making the survey all cooperating agencies agreed that the determination of irrigation water requirements by the Blaney-Criddle method, modified by field investigation, was satisfactory for this unit. This produced estimated consumptive use of irrigation water as shown in the following table.

Consumptive irrigation water requirements for Vernal unit area

Crop	Percent of area	Consumptive use: Frost-free period	Consumptive use: Pre & post frost-free period	Consumptive use: Total seasonal	1/ Effect. precipitation	Net seasonal consumptive use requirements
		Inches				
Alfalfa	37	21	4	25	3	22
Pasture	26	19	4	23	3	20
Corn 2/	9	19	-	19	2	17
Small grain	28	17	1	18	1	17
Average	100	-	-	-	-	20 3/

1/ Based on Bureau of Reclamation's formula of 90 percent of average seasonal precipitation for the 10 lowest growing seasons.
2/ Values permit maturity of corn. Predominant production in valley is for silage which would require lesser amounts of water.
3/ Weighted average for valley.

Management of water on the farm is now rather inefficient. With an adequate supply of late-season water in most years available as a result of the proposed development and with increased educational and technical assistance available to water users, it is reasonable to assume that an average irrigation efficiency of 55 percent can be obtained. Based on the probable crop distribution shown in the above table and an average irrigation efficiency of 55 percent, average

annual water requirements at the farm headgate will approximate 36.5 inches per acre. Actually, unit lands probably will receive no more water in total during the year than they do under present conditions but regulation of the stream flow by seasonal storage in Stanaker Reservoir will reduce the diversion from Ashley Creek in the spring and furnish this salvaged water when most needed late in the season.

Based on historical records of Ashley Creek, the proposed development is designed to deliver a full water supply in years of average water yield with shortages averaging about 15 percent in years of below-normal runoff. Infrequently there may be periods of one to three years when stream flow is so low that the water supply will be 40 percent of irrigation requirements averaged for the entire Vernal unit.

Projected Agricultural Economy

Information concerning present agriculture in the Vernal unit was obtained by the Field Party on 30 farms and by the Bureau of Reclamation on 57 farms. These records gave a picture of present agriculture in the Vernal unit area. Additional information was supplied by other local, state, and federal agencies.

Although the size of farms in the Vernal unit averages about 120 acres, most farms are smaller and much of the irrigated land is wet pastures and native hay meadows. The majority of the 300 farmers market their crops through dairy products, beef cattle, or sheep. There are about 100 dairy enterprises. Eighty-four cattle and sheep operators graze their stock during the spring, summer, and fall months on the Ashley National Forest and on other federal range administered by the Bureau of Land Management. They use the irrigated land in the valley chiefly as a winter feed base.

The average length of the frost-free season--119 days--restricts irrigated crops to comparatively short-season crops. An estimated projection of land in crops would be alfalfa, 37 percent; native hay meadows and irrigated pastures, 26 percent; small grains, 28 percent; and corn silage, 9 percent.

During the summer, when stream flow is low, available irrigation water is used first to mature corn silage, then small grains. Alfalfa and irrigated pastures suffer most with the present short water supply and probably will show the greatest increase in production when late-season water is provided. Water supply is the chief single factor controlling productivity of irrigated lands. A few farmers use commercial fertilizer effectively but the practice is not common. Increased use of fertilizer, improved water management on the farm, and generally better management of the land and crops can be expected when an adequate late-summer water supply is provided.

The projected agricultural incomes are based on projected prices released by the United States Department of Agriculture in 1956.

Three types of farms have been selected as the basis of income analysis. These types are Grade-A dairy, Grade-C dairy, and beef cattle.

The irrigable land in the projected budgets ranges from 80 to 160 acres. The weighted average acreages for the three land classes are 90, 112, and 151 acres with size increasing as soil production capacity decreases. On the basis of 14,114 acres of irrigable land in the project area, the average projected size is 116 acres, including farmstead and other noncropland in farms.

Net farm incomes for three yield levels are estimated at $4,069, $4,175, and $3,125 per farm. The average for all farms is $3,850. These amounts would be available for family living expenses, savings, and payment of water charges, including operation and maintenance.

Projected Additional Returns

With the additional water that the development would provide, the average net farm income from all land should be well over $5,000 per farm. After allocating interest on the farm investment and land improvements, an average of $3,850 remains to compensate for operator and family labor and for investment in irrigation water, including annual operation and maintenance costs.

Estimates of increased incomes have been made for three types and sizes of farms. The three budgets are Grade-A dairy, Grade-C dairy, and beef cattle. They are viewed as representing several kinds and variations in soils, farm types, and sizes of farms.

The estimated increases in net income with additional water are $14.91 per acre of productive land for the Grade-A dairy, $9.50 per acre for the Grade-C dairy, and $10.42 per acre for the beef cattle budget. An estimated weighted average for the three budgets is $11.85 per acre of cropland. Increased O & M costs are included in these averages.

At the present time, it is estimated that additional water would be supplied by the Vernal unit to about 13,500 acres of productive cropland. This acreage is net above farmsteads, ditches, and other noncropland estimated at about 5 percent of the total irrigable acreage. Application of $11.85 per acre to the total productive land shows an annual increase in agricultural income of about $160,000 for the Vernal unit.

Impacts of the Vernal Unit Area Upon the Administration, Management, and Use of the Ashley National Forest

A survey has been made by the Forest Service to determine the effects of proposed construction and operation upon the services and facilities now provided to public users of the Ashley National Forest. Effect upon present and anticipated future uses of timber, forage, recreational, and wildlife resources of the forest were also studied.

So far as can now be foreseen, the Vernal unit will not impair existing services or anticipated future services and facilities on the Ashley National Forest. Future uses of the resources provided by the forest will not be materially influenced by unit construction and operation.

Development of the Stanaker Reservoir and appurtenant structures is expected to create a demand for recreational use and may provide fishing opportunities. Any facilities provided for such uses as a part of the unit construction presumably will be administered and operated by state or local agencies. Their construction and operation will have very limited effect upon use and management of the national forest land.

Relationship of Watershed Conditions to the Vernal Unit Area

An appraisal was made of the extent to which conditions in the watershed above the proposed development, including the Stanaker Reservoir, might influence the success of the unit. Generally, vegetative cover and erosion conditions in the watershed are poor. Summer storms and spring snowmelt runoff cause some floodwater and sediment damage to agricultural lands and facilities. Heavy storms have occurred infrequently so that damages originating in the upper watershed area have not been as serious as watershed conditions might permit.

Land administering agencies, such as the Forest Service, Bureau of Land Management, State of Utah, and private land-owners, should orient their regular and special programs to restore and maintain a good cover of vegetation so that runoff will be retarded and erosion and the movement of sediment from watershed lands will be reduced. In time improved watershed management of all lands can reduce the present volume of damages. The floodwater and sediment damages, which now plague the irrigated lands, will continue to trouble the Vernal unit area to some extent.

It does not appear necessary to install any remedial measures in the upper portion of the watershed other than those which are normally a part of the regular programs of land-administering agencies. However, as administrators of federal lands and owners of private watershed lands improve present conditions and reduce the occurrence of damaging floods and erosion, unit maintenance costs will be reduced and operations will become less difficult.

CHAPTER I

GENERAL INFORMATION

Authority and Scope

This report on the Vernal Unit, Central Utah Project, Colorado River Storage Project, has been prepared by the United States Department of Agriculture in response to the President's letters of March 19, 1954 to the Secretary of Agriculture and the Secretary of the Interior. In his letters the President requested that a reappraisal of the direct agricultural benefits anticipated from the participating projects of the Colorado River Storage Project be made by the Department of Agriculture in cooperation with the Department of the Interior. Following the authorization of the Colorado River Storage Project by the Congress an understanding was reached late in July 1956 between the Secretary of Agriculture and the Secretary of the Interior regarding conduct of a survey to reappraise these direct agricultural benefits and to appraise project impacts. The Department of Agriculture survey was made under the authority of Section 6, Public Law 566, 83d Congress, as amended, which authorizes the Department to cooperate with other federal, state and local agencies in surveys and investigations of watersheds. The Utah State Agricultural College has also cooperated in the survey.

In addition to the agricultural phases, this report deals with the impacts of the unit on the national forests and the relation of watershed conditions to the unit. The report is intended to aid the Bureau of Reclamation in developing a sound unit plan.

Organization

Pursuant to the United States Department of Agriculture's Memorandum of Understanding dated February 2, 1956 between the Soil Conservation Service, Forest Service and Agricultural Research Service, a Field Advisory Committee, Colorado River Storage Project, composed of representatives of the above-mentioned agencies and a representative of the concerned state agricultural college participating, has been created to maintain appropriate liaison and to facilitate coordination of activities by the respective Services and the state agricultural colleges in the survey. This committee is also responsible for over-all relationships with the Bureau of Reclamation and other interested state and federal agencies.

A Field Party, working under the direction of the Field Advisory Committee and operating within a plan of work dated August 22, 1956, was responsible for the collection and analysis of data and for the preparation of this report.

Location and Physical Features 1/

The Vernal unit area is in the northeastern corner of Utah. It comprises the northern and central portions of Ashley Valley and is approximately centered by the town of Vernal. It is bordered by the Uinta Mountains on the north, a low mesa on the east and by Asphalt Ridge on the west. The area has no natural southern boundary but extends as far south in Ashley Valley as the main body of irrigated land. The southern portion of Ashley Valley, not included in the unit area, is composed primarily of waste land with only isolated tracts of arable land. The unit is all within the boundaries of the Uintah Basin Soil Conservation District.

Ashley Valley is drained by Ashley Creek, a tributary of the Green River, which in turn is a tributary of the Colorado River. The main tributary of Ashley Creek is Dry Fork Creek. Both Ashley and Dry Fork Creeks rise in small glacial lakes at the base of Marsh Peak (elevation 12,219 feet) in the Uintas. They run through deep canyons which they have cut through the upturned geological formations of the Uinta Range and converge about 5 miles northwest of Vernal. From this point Ashley Creek flows 20 miles in a southeasterly direction to its confluence with the Green River.

Heavy stands of timber interspersed with flat grassy parks and glacial lakes are characteristic of the upper reaches of the Ashley Creek drainage basin. Sagebrush and Juniper cover the lower hills.

Lands in the unit range in elevation from 4,700 feet in the southern portion of the area to 5,700 feet in the northern portion. The lands slope uniformly from the surrounding hills to Ashley Creek and are of gentle gradient. Several natural drainage channels drain into Ashley Creek, disecting the land into long flat ridges.

Climate

The Vernal unit area is characterized by rather wide extremes in temperature and precipitation. Ordinarily, summer days are warm with occasional short periods of hot weather. Summer nights are generally cool. Winters are cold and short. Maximum and minimum temperatures recorded at Vernal are 103° F. and -38° F., respectively. The mean annual temperature is 44° F. The humidity of the valley is unusually low.

The frost-free period averages 119 days. Killing frosts, however, have occurred as late as the middle of June and as early as the last day of August.

1/ The information from this part to the end of Chapter I has been supplied by the Bureau of Reclamation

Winds are common but seldom violent. During the spring months westerly winds often blow for several days at a time. Hailstorms are rare and seldom damage crops.

Precipitation averages 8.5 inches annually but varies widely from year to year. Variations are 17½ to 5½ percent of normal. Summer rains frequently augment the stream flow during July, August, and September. At times these storms reach cloudburst proportions and cause some damage. Annual precipitation in the mountains to the north, chiefly winter snows, averages more than 19 inches.

Present Agriculture

History of Development

Settlement of Ashley Valley began in 1873 when Pardon Dodds, an indian agent from the Uintah-Ouray Indian Agency, established a ranch in the valley north of the present site of Maeser. In the following year other ranchers made their homes in the valley, constructed ditches and began to irrigate large tracts of land. The first ranches were devoted to livestock which utilized the grazing resources adjacent to the valley. General farming subsequently became the standard agricultural pattern. By 1900 most of the irrigable lands in the valley had been placed under production. Since 1900 only small areas have been developed. The tendency has been to divide original holdings to provide a livelihood for more families.

Agricultural Development

General farming is the major industry of the unit area. Agricultural development centers around livestock production and the raising of forage crops and small grains for livestock feed. Sheep and cattle are grazed in the nearby Ashley National Forest and on federal range lands under the administration of the Bureau of Land Management. Although it is the mainstay of the area's economy, production of crops and livestock is limited by the erratic water supplies. Crop yields are low and outright crop failures occur.

Several industries centered around agricultural production have been established in the unit area. These include creameries, a flour mill, and meat-processing plants.

Industrial Development

Agriculture is followed in industrial importance by the production and processing of large deposits of mineral resources. Gilsonite, a hydrocarbon found only in the Uintah Basin, is mined at several points and is used in a variety of products such as battery cases, paints, varnishes, and roofing compounds. Its exploitation has attracted a large amount of outside capital. Native rock asphalt, another hydrocarbon, is mined from extensive deposits in Ashley Valley west of Vernal.

Oil is produced in the southern portion of Ashley Valley as well as in the nearby Rangely district. Most of the oil is transported by pipeline for processing in Salt Lake City but a small refinery at Jensen produces gasoline and other petroleum products for local consumption.

Lumber from nearby forests is processed for local consumption by a number of small mills. Mine timbers are cut and hauled to the Carbon coal area in Utah and the Sweetwater district in Wyoming.

Irrigation Development

Ashley Creek is characterized by high discharges from snowmelt in May and June followed by rapidly receding flows which are far below irrigation requirements. As early as 1888, efforts were made to develop storage for the erratic water supply. To-date, however, only 1,600 acre feet of storage capacity is available on Ashley Creek. Most of this is provided in a group of small glacial lakes (Long Park, Twin Lakes and Goose Lake) on the headwaters of Ashley Creek. An additional 6,700 acre feet of capacity is provided for Ashley Valley in Oaks Park Reservoir on Brush Creek which lies north of Ashley Creek. Water is diverted by a transmountain canal from the reservoir to Ashley Creek.

Presently-irrigated lands are served by seven major canals and ditches diverting from Ashley Creek. These include the Ashley Upper, Ashley Central, Highline and Rock Point Canals and the Island, Stanaker and Dodds Ditches. The Colton Ditch is combined in the Ashley Upper Canal and the Hardy Ditch in the Ashley Central Canal. In addition to the diversions by the main canals and ditches, there are some small diversions made by individuals or small groups of private interests. In the southern portion of the Ashley Valley the Union and Riverdale Canals supply some small areas with return flows from irrigated lands in the unit area.

Diversion dams on Ashley Creek are adequate but require considerable maintenance. Some canal structures are not adequate. Also, the lack of measuring devices makes equitable distribution of available water supplies extremely difficult.

Economic Conditions

The agricultural economy of the area is unstable, a condition fostered, to a great extent, by insufficient late-season irrigation water. Farms are generally too small to provide an adequate family income without an increased water supply. This situation has been aggravated by the concentration in Ashley Valley of a larger population than the area can support with the present unstable irrigation water supply.

An alleviating factor has been some off-the-farm employment provided by local coal and gilsonite mines, sawmills and more recently the expansion of operations at the Rangely oil field.

Presently-irrigated lands have an inadequate late-season water supply and nearby areas of arable land are lying idle for lack of water. At the same time, high spring flows run unused because storage facilities are not available to smooth out the flows to meet beneficial use requirements.

Additional irrigation water, properly distributed throughout the growing season, is the greatest need of the unit area. Late-season water is urgently needed to bring crops to full maturity. Because of the condition of the range lands, additional forage crops are required to supplement grazing and stabilize the livestock industry.

Industrial growth in the unit area will require the development of a new municipal water supply and a source of low-cost electrical energy. Development of the municipal water supply has been made in the past at the expense of irrigation. Now the supply is barely adequate to meet existing needs.

General

Vernal, situated near the center of the unit area, is the largest trading center within a radius of 80 miles and is the only major community within the area. The farm population is concentrated in the rural communities of Maeser, Naples, Glines, Ashley, and Davis.

Present estimates place the population of the unit area at 6,270. Approximately 300 farm families reside in the area. A marked increase in population has resulted since 1944 from expansion of the oil industry in the Rangely district of Colorado, 50 miles east of the unit, and from a new oil field in the southern portion of Ashley Valley. Because Vernal is the nearest trading center, it has absorbed most of the influx of workers and prospectors. Many new homes and business buildings have been constructed to meet housing and business needs.

U. S. Highway 40--one of the Nation's chief transcontinental routes--passes through Vernal, connecting the town with Salt Lake City, 180 miles to the west, and Denver, 340 miles to the east. Adequate roads connect the outlying districts of the unit area with Vernal. Frontier Airlines provides service from Vernal to Salt Lake City, Utah, Rock Springs, Wyoming, and Grand Junction, Colorado. The area has no railroad facilities. The nearest accessible rail terminals are at Craig, Colorado, 120 miles east of Vernal, and at Heber, Utah, 130 miles to the west.

Electric energy is supplied to Vernal and the immediate vicinity by the Utah Power & Light Company and the Moon Lake Electric Association, a Rural Electrification Administration cooperative.

Domestic water is supplied to Vernal and adjoining communities from springs in Ashley Creek near the hydroelectric power plant of the Utah Power & Light Company.

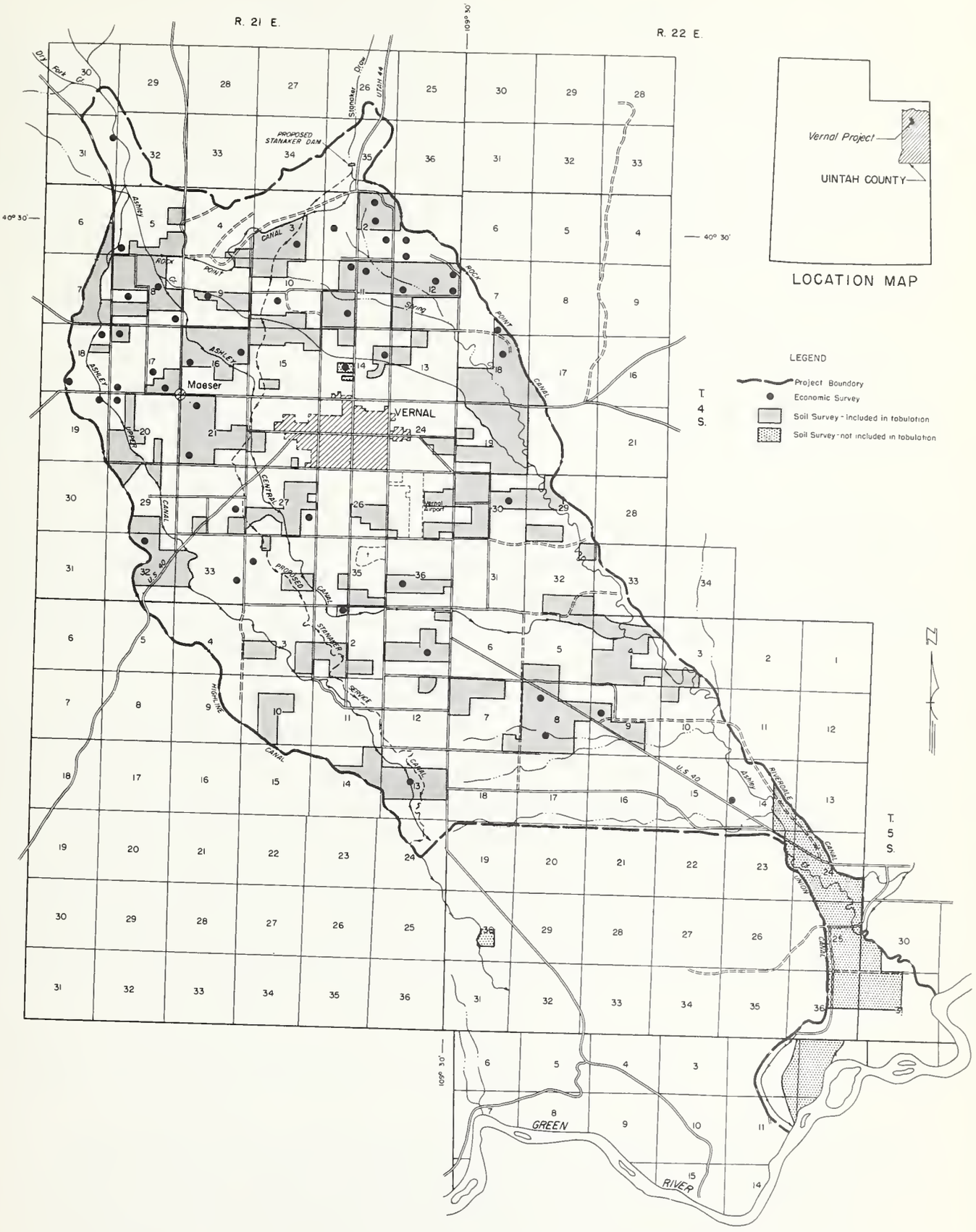
Elementary schools at Vernal, Maeser, and Naples serve the entire project area. Students are transported by bus from the outlying areas. A high school in Vernal serves most of Uintah County.

Recreational areas have been set aside within the nearby Ashley National Forest for the use of picnickers and tourists. Recreational use is not highly developed but many excellent sites are available for development.

Proposed Development

The Vernal unit, through storage, regulation, and exchange of water, would meet the area's urgent needs for municipal and irrigation water by controlling the fluctuating flow of Ashley Creek at Stanaker Reservoir. This reservoir, with an active storage capacity of approximately 34,000 acre feet, would be formed by an earthfill dam at an off-stream site 3½ miles north of Vernal, Utah. It would be utilized primarily for irrigation and would make possible a supplemental water supply for 14,114 acres of farm land inadequately irrigated.

Water would be conveyed to the reservoir from Ashley Creek through the Stanaker feeder canal. As needed, water would be conveyed from the reservoir to the project lands through the Stanaker service canal. Lands not under the service canal would be furnished supplemental irrigation water through existing canal systems.



SAMPLE AREA MAP

VERNAL UNIT, CENTRAL UTAH PROJECT

UINTAH COUNTY, UTAH

OCTOBER, 1956

SCALE IN MILES

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

7-P-17086-L

CHAPTER II

EVALUATION OF DIRECT AGRICULTURAL BENEFITS TO BE EXPECTED FROM VERNAL UNIT, CENTRAL UTAH PROJECT

This report is based on field data and published reports, the combined judgment of agricultural technicians familiar with the unit area, and its agricultural problems and conditions.

Preliminary project reports, land classification maps and field sheets, farm schedules, and other data collected by the Bureau of Reclamation have been used to acquaint technicians with present conditions and proposed developments.

The above information was augmented with additional soil surveys, field investigations, engineering surveys, crop yield determinations, and irrigation water investigations by members of the Field Party as well as local representatives of the Forest Service, Soil Conservation Service, Agricultural Research Service, and Bureau of Reclamation. These additional surveys were made where available information did not give an adequate sample.

In addition, assistance from representatives of the Utah Cooperative Extension Service, Utah Agricultural Experiment Station, State Forester, Utah Water and Power Board, Farmers Home Administration, state and county Agricultural Stabilization and Conservation Committees, Bureau of Land Management, and others has been valuable in preparing the report.

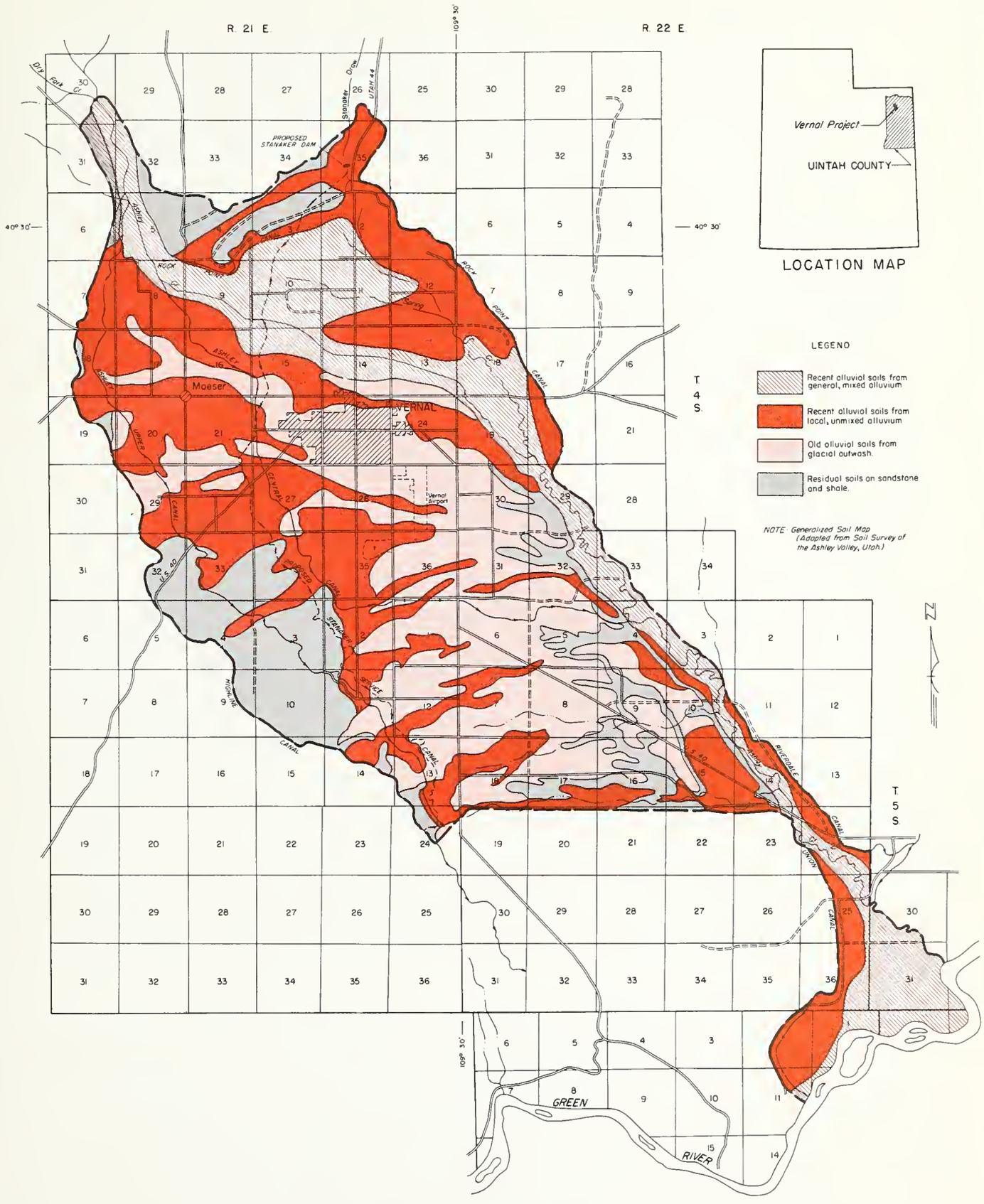
Soils Information

General Description of Soils

Information on the soils of the unit area was derived from the compilation of soil conservation surveys made on a farm-to-farm basis. Existing surveys were widely scattered and gave a representative sample of the area. (See sample area map.) An additional 1,200 acres were surveyed to improve the sample. The total of 10,824 acres surveyed represents a 28 percent sample of the 38,439 acres of agricultural land in the unit area. The United States Department of Agriculture, Bureau of Soils, published report "Soil Survey of the Ashley Valley, Utah," was also used as reference material.

Based on soil characteristics and origin, soils in the unit area were divided into four categories as follows:

1. Recent alluvial soils from general, mixed alluvium are of the Ashley and Greenriver series. They are found along the permanent major streams, Ashley Creek, and the Green River. The recent alluvium from which they are derived has been transported for relatively long distances. It comes from a variety of parent materials. Most of these soils are sandy loams underlaid by gravel and sand. The depth to gravel varies from a few inches to more than six feet. These soils are subject to occasional stream overflow. Usually soils in this category have a water table that fluctuates with the stream flow.



GENERALIZED SOIL MAP
VERNAL UNIT, CENTRAL UTAH PROJECT
UINTAH COUNTY, UTAH

OCTOBER, 1956

SCALE IN MILES

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

7-P-17084-L

2. Recent alluvial soils from local, relatively unmixed alluvium are of the Redfield, Naples, and Billings series. The first two have deep, well-drained, loamy profiles, and are derived largely from sandstone and sandy shales. Billings soils are formed in local alluvium from Mancos shale and have clay loam profiles. Some gravelly and cobbly soils are included in this category. Recent surveys have indicated the presence of additional series in this category. Christianburg soils include the clay and silty clay soils and Ravola, the loamy soils formerly included in the Billings series.

3. Old alluvial soils from glacial outwash are of the Mesa series. They are found on remnants of a glacial outwash plain laid over the Mancos shale. Subsequent erosion and dissection of the plain left flat-topped ridges and mesas from which the series name is derived. The Mesa soils are about 10 to 20 inches deep over limy cobble and gravel. A deep member of this category, the Fruita series, and a shallow member, the Naturita series, have recently been recognized and mapped.

4. Residual soils on sandstone and shale occupy only a small part of the land in the unit area. The Shavano soils formed on sandstone and the Chipeta on Mancos shale are the principal members of this category. They are shallow, non-arable soils.

Major soils problems in the unit area can be divided into two kinds predicated on the practices required for their solution. The practices are designated as "recurring" and "non-recurring". Recurring practices are those such as maintenance of soil organic matter, structure, and fertility. These are commonly called"management" practices. They are accomplished by using a high level of management which includes crop rotations, fertilizer application, irrigation water management, crop residue management, etc. The non-recurring practices include leveling, drainage, leaching of salts, and others which once accomplished need not be done again. They do, however, require maintenance.

Non-recurring practices may be needed but not practicable. Leveling, for example, is needed to some extent on nearly all land in the unit area to obtain improved water application. However, some soils do not lend themselves to leveling.

Areas with salt or alkali problems are scattered throughout the unit area. They reflect topographic, drainage, or location conditions rather than an inherent soil characteristic. The effect of the salt varies with the concentration, kind of salt, and soil texture. In nearly all instances the salty areas are also affected by high water table. There are, however, numerous areas with high water table that are not affected by salt. Out of 36,209 acres of agricultural land in the Vernal unit area, about 4,530 acres are affected by salt (principally sodium sulphate) and water table, and 4,119 acres by water table alone. Alkalinity alone or in combination with salinity or water table plus salinity alone affect only a small acreage in the unit area.

Generally salt and water table problems can be corrected by providing adequate drainage and sufficient irrigation water to leach the salt and maintain it at a low concentration. However, specific corrective measures for saline or alkaline soils cannot be made without further investigation.

The Bureau of Reclamation Land Classification Survey recognizes the following classes of land in the unit area:

Class 1 - This land is the best land of the unit area and is suitable for production of all climatically adapted crops.

Class 2 - This land is of moderate utility for irrigation farming with a measurably lower productive capacity than Class 1.

Class 3 - Marginal land or land of distinctly restricted suitability for irrigation farming.

Classes 2 and 3 are further subdivided because of soil limitations "s" and roughness of topography "t" or a combination of the two.

The soil survey made by the Soil Conservation Service maps characteristics which can be used for grouping soils in the capability classification. This classification divides the arable lands into four broad land capability classes designated by roman numerals from I to IV. The larger the number the greater the permanent limitation in use. The class number indicates the degree of limitation and the intensity of management needed to maintain the land in production without deterioration. A brief description of each land capability class follows:

Class I - Good cultivatable land with no limitations in use. Suitable for general farming.

Class II - Good land that has minor limitations in use. Example: clay loam soil needing fall plowing because it is slow to "warm up" in the spring.

Class III - Good land that has major limitations in use. Example: slope requiring close-growing crops and extra care in irrigating.

Class IV - Fairly good land that has limitations that make it suitable for only occasional cropping or has a narrow range in crop adaptation because of unfavorable soil or environment characteristics.

Each class, except Class I, is divided into subclasses based on the kind of permanent limitation. The subclasses are shown by these lower case letters:

c - Climatic limitation - frost hazard, precipitation too low, or irrigation water not economically available.

e - Slope or erosion limitation or both.

s - Soil limitation - shallowness, too coarse or too fine textured, salinity, alkalinity, stoniness or other unfavorable soil characteristics permanently limiting the use of the land.

w - Excessive water in the soil or flooding which cannot economically be corrected.

In the land capability classification, the soil units shown on the soil survey maps are combined into groups of soils with similar physical characteristics, management requirements, and responses. The major characteristics used to determine the group into which each soil is placed are: moisture supplying capacity, texture, depth to inhibiting layers, permeability of subsoil and substratum, and tendency toward erosion or deterioration. Each soil group has been assigned a capital letter designation for identification.

The combination of land capability class number, subclass letter, and soil group letter make up the land capability unit.

Table 1 gives a brief description of the soil groups found in the Vernal unit area.

Table 1.-Description of soil groups

Soil group	Description
A	Loam surface soil. Permeable subsoil and substratum. Soil more than 36 inches deep to permeable inhibiting layer such as gravel. No impermeable horizons within 5-foot profile.
B	Sandy loam surface soil. Permeable subsoil and substratum. Soil more than 36 inches deep to permeable inhibiting layer such as gravel. No impermeable horizons within 5-foot profile.
C	Clay loam surface soil. Permeable subsoil and substratum. Soil more than 20 inches deep to permeable inhibiting layer such as gravel. No impermeable horizons within 5-foot profile.
E	Loam surface soil. Subsoil or substratum is very rapidly permeable. Soil tends to be droughty. Soil more than 20 inches deep to gravel or cobble. No impermeable horizons within 5-foot profile.
F	Sandy loam surface soil; otherwise, same as Group E.

Table 1. (cont.) - Description of soil groups

Soil group	Description
H	Clay surface soil. Subsoil and substratum slowly to rapidly permeable. More than 36 inches to gravel or other permeable inhibiting layer. No impermeable horizons within 5-foot profile.
J	Clay loam surface soil. Subsoil slowly to rapidly permeable. Restricting material may be within 20 to 36 inches.
K	Loam surface soil. Subsoil slowly to rapidly permeable. Restricting material may be within 20 to 36 inches.
L	Loam to sandy loam surface soils. Subsoil slowly to rapidly permeable. Shallow (10 to 20 inches) to gravelly material.
L_1	Clay loam surface soil. Subsoil slowly to rapidly permeable. Shallow (10 to 20 inches) to gravelly material.
M	Sandy loam surface soil. Slowly to rapidly permeable subsoil. Restricting material may be within 20 to 36 inches.
N	Sandy loam to sand surface soil. Deep soil with fair moisture-holding capacity.
P	Clay loam to clay surface soils. Very slowly permeable subsoil or substratum. Water movement restricted in profile.
R	Loam to sandy loam surface soil. Very slowly permeable subsoil. Water movement restricted in profile.
S	Clay loam to sandy loam surface soil. Very shallow (less than 10 inches) over gravel, sandstone, hardpan, or shale.
T	Clay loam to sandy loam surface soil. Slowly to rapidly permeable subsoil. Shallow (10 to 20 inches) over sandstone, shale, or hardpan.
U	Sand to sandy loam surface soil. Very rapidly permeable subsoil or substratum. Very droughty. Gravel may lie within 20 inches.

Table 2 gives a list of the land capability units and the acreage of each. The acreage figures are extrapolations of the sample area consisting of 10,824 acres that were surveyed by the Soil Conservation Service. It is apparent that with surveys made on the basis of different criteria and with a different end result in mind, a direct comparison of results is difficult.

A summary of the Soil Conservation Service Land Capability Classification shows that 3,167 acres of Class I land can be used for the production of all crops usually grown in the area with no limitations in use. There are 19,705 acres of Class II land with minor limitations in use. This land will grow any of the usual crops but some special handling or management is required. In Class III land there are 4,552 acres which are good land for crop production but are limited by some hazard that requires rather complex management practices to prevent deterioration. Class IV land includes 1,744 acres which can be cropped occasionally but, because of severe limitation in crop suitability or erosion hazard, is best kept in hay or pasture. The remaining 7,041 acres of agricultural land should be left in native grasses or seeded to grass and used with care. *For various reasons, 737 acres are non-agricultural.

Findings

Based on the survey of the representative sample and by comparison with the Bureau of Reclamation Land Classification, it is concluded that:

The 14,114 acres for which the Bureau of Reclamation plans to supply additional irrigation water are suitable for long-continued cultivation under irrigation.

Classes II and III include an additional 13,310 acres which have correctable limitations. The majority of this acreage is affected by water table alone or in combination with salinity and uneven topography. In addition, a small acreage is affected by limitations of stoniness and alkalinity. With these limitations removed and irrigation water available, these lands would be suitable for continuous cultivation under average management. Additional investigations would determine treatment and management required for development.

There are approximately 1,744 acres of land suitable for irrigated pasture and occasional cultivation with proper land treatment if additional irrigation water were made available.

Table 2.-Land capability classes, Vernal unit area

Land capability unit	Acres of land with no limitation in use 1/	Acres of land with correctable limitations in use: Undulating slope only	Undulating slope and/or others	Total acres
I A	731	742	1,476	2,949
I B		80	138	218
Total I	731	822	1,614	3,167
IIe A	6,095	949	1,969	9,013
IIe B	674	159	390	1,223
IIs C	1,322	267	868	2,457
IIs E	133	1,025	1,615	2,773
IIs F	1,452	1,122	1,665	4,239
Total II	9,676	3,522	6,507	19,705
IIIe A	388	238	119	745
IIIe B	395	159	22	576
IIIe C	76		36	112
IIIe F	579	105	210	894
IIIe E	36			36
IIIe L	119			119
IIIe M	22			22
IIIe K	25			25
IIIs J	50	33	43	126
IIIs K	372	109	123	604
IIIs L	239	286	735	1,260
IIIs L1	18		15	33
Total III	2,319	930	1,303	4,552
IVe A	22			22
IVe B			33	33
IVe F	22		36	58
IVe K			25	25
IVe L	286		452	738
IVe M	18		33	51
IVe T	22			22
IVs L			33	33
IVs P		40	43	83
IVs R		36	14	50
IVs S		7	80	87
IVs T	7		67	74
IVs U		138	192	330
IVs V	33	18		51
IVw A			11	11
IVw E			33	33
IVw F			43	43
Total IV	410	239	1,095	1,744

1/ Land leveling on these acres may be advantageous to improve efficiency of irrigation water application and crop yield.

Improvement of Existing Irrigated Lands

General

Substantially all lands within the Vernal unit area are presently under cultivation. The water supply in the past has been so erratic that no prudent basis has existed for the improvement of most of the lands to their ultimate potential capability.

Past experience in areas of similar characteristics has shown that with the development of a reliable water supply an increase in the amount and rate of application of land improvement practices has occurred. This has been particularly noted when sufficient technical assistance has been available to aid farmers in the installation of practices and to assist farmers in adopting improved methods of water management in these cases.

Increased returns from the application of these practices coupled with improved water management have amounted to approximately 20 percent per annum of the installation costs, divided between increased production and lower operating costs.

Future land improvements, including such items as improved ditch and water distribution systems and accurate land leveling, will be made at an increasing rate when a firm water supply is available. This will result in better land and water management with consequent additional improvement in the agricultural economy of the area.

Land Clearing

Inasmuch as no new lands are planned for inclusion in the unit area at this time, clearing and grubbing will be required only in isolated spots. The area and amount of such work is insignificant over the unit area as a whole and, therefore, no estimate has been made of this item of land improvement.

Land Leveling

Leveling is an operation commonly required on irrigated land and constitutes a major expense in the improvement of land for its highest potential agricultural use. It is defined as "the reshaping of the land surface to a planned grade to permit uniform distribution of irrigation water without erosion or to provide necessary surface drainage". The operation does not necessarily imply the removal of all slope or gradient from the land surface but rather the elimination of surface irregularities which impair the uniform application of irrigation water.

Leveling requirements and costs vary widely with soils and site conditions. To-date this work has been accomplished on about 3 percent of the presently-irrigated acreage in the unit area. Table 3 summarizes the earthwork requirements on the completed land leveling.

Table 3.- Land leveling accomplished to-date, Vernal unit area

Slopes	Average earthwork required cubic yards per acre
Less than 2%	240
Approx. 2%	300
Approx. 3%	414

In connection with regular operations Soil Conservation Service technicia have assisted in the preparation of conservation plans for farmers who are cooperating with the Uintah Basin Soil Conservation District. Based on the needs of the land, these conservation plans indicate the various types and amounts of works of improvement the farmer plans to install on his farm.

An examination of 19 conservation plans selected at random comprising 2,307 acres of cultivated lands in the Vernal unit area showed that land leveling was planned on 46 percent of the cultivated area. Since the conservation plans prepared to-date include a disproportionate share of the better lands in the valley, it appears that this ratio of land leveling needs may be below average for the area. Also, that the leveling requirements on these lands, in terms of earthwork per acre, are somewhat less than average for the area. Soil Conservation Service technicians working in the area estimate that not less than 60 percent of all irrigated lands within the unit area would require leveling. An additional 30 percent of the irrigated land would require some leveling to attain efficient water management.

Table 4 illustrates estimated earthwork yardage and average cost per acre for land leveling requirements within the area. Degree of development encompassed within these estimates would permit maximum efficiency of irrigation water application and implies a high level of soil and water management.

Table 4.- Estimated cost of anticipated land leveling in Vernal unit area 1/

Estimated cubic yards of earthwork per acre 2/	Estimated acres to be leveled 3/	Estimated cost per acre leveled 4/
		Dollars
350	3,026	63
400	4,790	72
500	2,887	90
600	540	108
700	270	126

1/ All cost estimates based on composite index for construction in USDA pamphlet "Agricultural Price & Cost Projections" published June 1956.
2/ Based on past experience in the valley.
3/ With the unit; acreage projected.
4/ At $0.18 per cubic yard.

Drainage

Based on Soil Conservation Service Land Capability Classification, there are 8,649 acres of land within the boundary of the Vernal unit area that are too wet for maximum crop production. The wet condition of a large share of this land is caused by excessive use of irrigation water in the spring. A considerable amount of this land has been eliminated from the Bureau of Reclamation Land Classes 1, 2, and 3 and will not be eligible for water from this irrigation development. The areas of wet lands remaining in the unit area will be corrected either by unit drainage as a part of the development or by individual land owners. No specific drainage recommendations can be made at this time.

The unit development will store excessive spring flow for use later in the year. Spreading the use of spring water flows over the year will have a tendency to shift or eliminate some of the wet conditions. Overall estimates of drainage should be deferred until the unit is in operation for a few years. Drainage investigation will then be more realistic as to cost, locations, and type required. The slope and relief of the entire unit area are such that drainage outlets may be obtained with only moderate difficulty.

In the interim period between initiation of the development and when drainage needs can be adequately appraised, there is some preventative work that can be done. Canals running through gravel or other permeable areas can be lined. Application of irrigation water can be improved to reduce waste. Isolated wet spots in fields can be drained. Such drainage, including outlets, will cost approximately $100 per acre.

Farm Irrigation Ditches

To take maximum advantage of the water supplies that will be available, extensive alterations of the existing on-farm irrigation systems are desirable. The principal requirements will be in new and reconstructed ditches and ditch structures.

Substantial amounts of field ditch construction will be required. The 1,068 acres of land leveling, which was planned on the 19 farm conservation plans examined, required an average of 81 feet of new ditch per acre leveled. Due to land slopes, small fields, short runs, and other factors, it is estimated that new ditch construction will average about 100 feet per acre at a cost of approximately 3 cents per foot. Farm laterals will also be required but no estimate of the quantity can be made at this time. Many existing farm laterals and structures may continue in service indefinitely.

Where ditch lining is required for both permanent field ditches and farm laterals, the cost will approximate $2 per lineal foot. Alternate pipeline installation will average between $1.50 and $2 per foot.

It is estimated that one ditch structure per 300 feet of ditch or per 3.7 acres of land leveling will be required. These structures would be principally dividers or drops and each would average less than 1 cubic yard of concrete. In addition, one ditch check would be required per acre. Ditch structure requirements will approximate $\frac{1}{4}$ cubic yard of concrete per acre at a cost of not less than $50 per cubic yard.

It is estimated that the cost of reorganizing a farm irrigation system will be $3 per acre for farm ditches and $12.50 per acre for ditch structures.

Findings

Present farm irrigation systems and land development are below the standard necessary to obtain maximum crop production and efficient use of irrigation water. Additional land development that will be required to obtain maximum crop productivity and most efficient use of irrigation water will cost from about $75 per acre for Class 1 land to about $100 per acre for Class 3 land.

Irrigation Requirements

Sources of Data

Considerable information is available concerning consumptive use and irrigation water requirements for the Vernal unit area. Detailed investigations of water use have been made by the Utah Agricultural Experiment Station, in cooperation with the Utah State Engineer and the Department of Agriculture, within the Vernal unit area. Data from these investigations have made additional field work unnecessary at this time. These reports and others have been carefully reviewed and abstracted. In addition, information has been supplied by technicians from the Agricultural Research Service, Utah Agricultural Experiment Station and Soil Conservation Service familiar with the area.

Several methods of estimating irrigation water consumptive use requirements for various crops in an area are available. Among these are the Blaney-Criddle, Thornthwaite, Penman, and Lowery-Johnson procedures. When sufficient basic data are available and applied with the necessary interpretative skill, all methods give comparable results.

Inview of the simplicity of the computations and generally satisfactory results, the Soil Conservation Service has adopted the Blaney-Criddle procedures. Other irrigation agencies and technicians readily accept the results of this method; therefore, it has been used in the determination of irrigation water consumptive use requirements for this report.

Analysis of Data

The flow of Ashley Creek--the main source of irrigation water for the Vernal unit area--varies widely with the seasons. The water supply is quite large during the spring snowmelt season with more water available than can be used; therefore, the surplus is bypassed to the Green River. Later in the summer when crop water demands are higher, Ashley Creek flow usually decreases to an amount insufficient to meet crop needs. However, except in the very driest years, the total volume of water in Ashley Creek, if properly distributed throughout the season, would be sufficient to meet the irrigation demands of lands to be served by the unit. Thus, the principal irrigation water supply problem for the valley is the correction of the unfavorable seasonal distribution of the natural flow. Construction of the Stanaker Reservoir and its appurtenant works, together with exchanges of natural flow rights for storage water rights, will insure a more uniform distribution of water throughout the growing season.

Water rights in the Vernal unit area have been based upon percentages of flow rather than beneficial use requirements. Existing records of past diversions were analyzed and found inadequate to determine the actual amounts of water applied. These records do not give a reliable basis for estimating past water shortages because the maximum amount available is diverted regardless of crop requirements in an attempt to store water in the soil to offset late-season shortages. The

total volume of water diverted frequently exceeds the calculated total annual requirement. The excess water applied in the spring has further reduced crop yields and income due to water logging land, leaching of plant nutrients, chilling the soil in the spring, and interfering with normal functions of micro-organisms or plant roots.

An estimate of the late-season deficiency may be made by comparing the daily hydrographs of Ashley Creek with water requirements of the crops computed by consumptive use methods. Such a study shows that in 72 percent of the years Rockpoint Canal has furnished a full water supply to the lands it serves. The Ashley Upper and Ashley Central Canals average 36 percent of the years for full water supply to their respective lands. The Highline Canal furnished full water supply to the land it serves only 23 percent of the years. Additional computation on the Highline Canal reveals that water was furnished only in June for 40 percent of all years with no water available for the critical months of July and August for these same years.

Further analysis of records by inflow-outflow-consumptive use methods and eliminating excess spring irrigation indicate that the water supply for the lands of the valley average approximately 40 percent less than the season requirement with a maximum shortage of approximately 70 percent in the worst years.

Average consumptive use requirements for principal crops grown in the area have been estimated by the Blaney-Criddle procedures modified by field investigations conducted by the Utah Agricultural Experiment Station and others. The resulting seasonal consumptive use requirements are shown in Table 5.

Table 5.-Consumptive irrigation water requirements for Vernal unit area

Crop	Percent of area	Consumptive use: Frost-free period	Consumptive use: Pre & Post frost-free period	Consumptive use: Total seasonal	Effect. precipitation 1/	Net seasonal consumptive use requirements
Alfalfa	37	21"	4"	25"	3"	22"
Pasture	26	19"	4"	23"	3"	20"
Corn 2/	9	19"	-	19"	2"	17"
Small grain	28	17"	1"	18"	1"	17"
Average;	100	-	-	-	-	20" 3/

1/ Based on Bureau of Reclamation's formula of 90 percent of average seasonal precipitation for the 10 lowest growing seasons.
2/ Values permit maturity of corn. Predominant production in valley is for silage which would require lesser amounts of water.
3/ Weighted average for valley.

In the past irrigation water has been applied to maintain as high a level of soil moisture as possible even above field-holding capacity whenever water was available. An analysis of existing farm irrigation efficiencies would be pointless in view of this situation. Information on efficiencies of irrigation water application from other areas of similar characteristics and irrigation requirements furnishes a better indication of prospective irrigation efficiencies for the Vernal unit area after the farmers have adjusted to improved water supply conditions.

Farm irrigation efficiencies are principally affected by (1) seepage from farm ditches or laterals, (2) waste or tailwater discharged from the lower edge of field and not reused elsewhere on the farm, and (3) losses through deep percolation. Experience elsewhere indicates that under climatic and soil conditions similar to those in the Vernal unit area losses would total 45 percent, thus making over-all farm efficiency approximately 55 percent of the water delivered at the farm headgate. Obviously this degree of efficiency of water application will not be attained immediately. Drastic changes in the pattern of water delivery will occur when operation of the unit goes into effect and is expected to result in some immediate improvement of water management.

By using a weighted average consumptive use requirement of 20 inches of water (table 5) and a farm application efficiency of 55 percent, the average farm delivery requirement would be 36½ inches of irrigation water per acre. Crop requirements will vary throughout the season in accordance with plant maturity and other factors. The delivery system and structures should be designed to provide adequate capacity during periods of maximum use requirements. These maximum requirements are presently estimated on the following basis.

Table 6.-Maximum daily use requirements, acre inches per acre, Vernal unit area

Crop	Net water replacement requirements in soil profile			
	3"	4"	5"	6"
Alfalfa	.29"	.27"	.25"	.24"
Pasture	.27"	.25"	.24"	.22"
Corn	.24"	.22"	.21"	.20"
Small grain	.21"	.19"	.18"	.17"

The construction of Stanaker Reservoir will permit the storage in the spring of surplus water for release to meet late-season irrigation requirements. The storage site, however, is not adequate for economical construction of a reservoir large enough to provide substantial carry-over storage from one year to the next. The wide variations in yearly discharge of Ashley Creek will occasionally result in periods when the total runoff will not provide storage water sufficient to meet irrigation needs.

On the basis of inflow-outflow-consumptive use studies, the unit will provide adequate water for lands in Bureau of Reclamation Land Classes 1, 2, and 3 for years of average runoff. In years of below-average runoff, it is estimated there will be an average shortage of 15 percent of the irrigation requirements. A probable maximum deficiency is 57 percent of consumptive use requirements in the lowest runoff years.

Table 7.- Summary of Vernal unit water supply deficiencies 1/

	Minimum deficiency in water supply (percent)	Average water supply deficiency, all years (percent)	Average shortage in years of deficient water supply (percent)	Maximum water shortage in years of extreme deficiency in runoff (percent)
	Gravity flow service area above proposed Stanaker service canal			
Before unit	51	71	71	94
With unit	0 2/	11	24	68
	Reservoir service area below proposed Stanaker service canal			
Before unit	10	36	36	74
With unit	0 2/	4	8	50
	Entire Vernal unit area combined totals weighted values			
Before unit	27	50	60	82
With unit	0 2/	7	15	57
Improvement with unit	27	43	45	25
Increase in water supply at farm headgate with unit	3/ 10,000 a.f.	3/ 4/ 15,000 a.f.	3/ 18,000 a.f.	Variable

1/ Based on detailed study of unit hydrographs of Ashley Creek flow, 1925-55.
2/ 58 percent of time.
3/ All in late-season critical periods.
4/ Approximately 18,000 acre feet at point of diversion.

Forecasts for runoff on Ashley Creek have been made in recent years through the Cooperative Snow Survey & Water Supply Forecast Program. Extension of the snow survey program and more widespread use of the resulting information would allow farmers in the area to adjust their operations, when deficient runoff is anticipated.

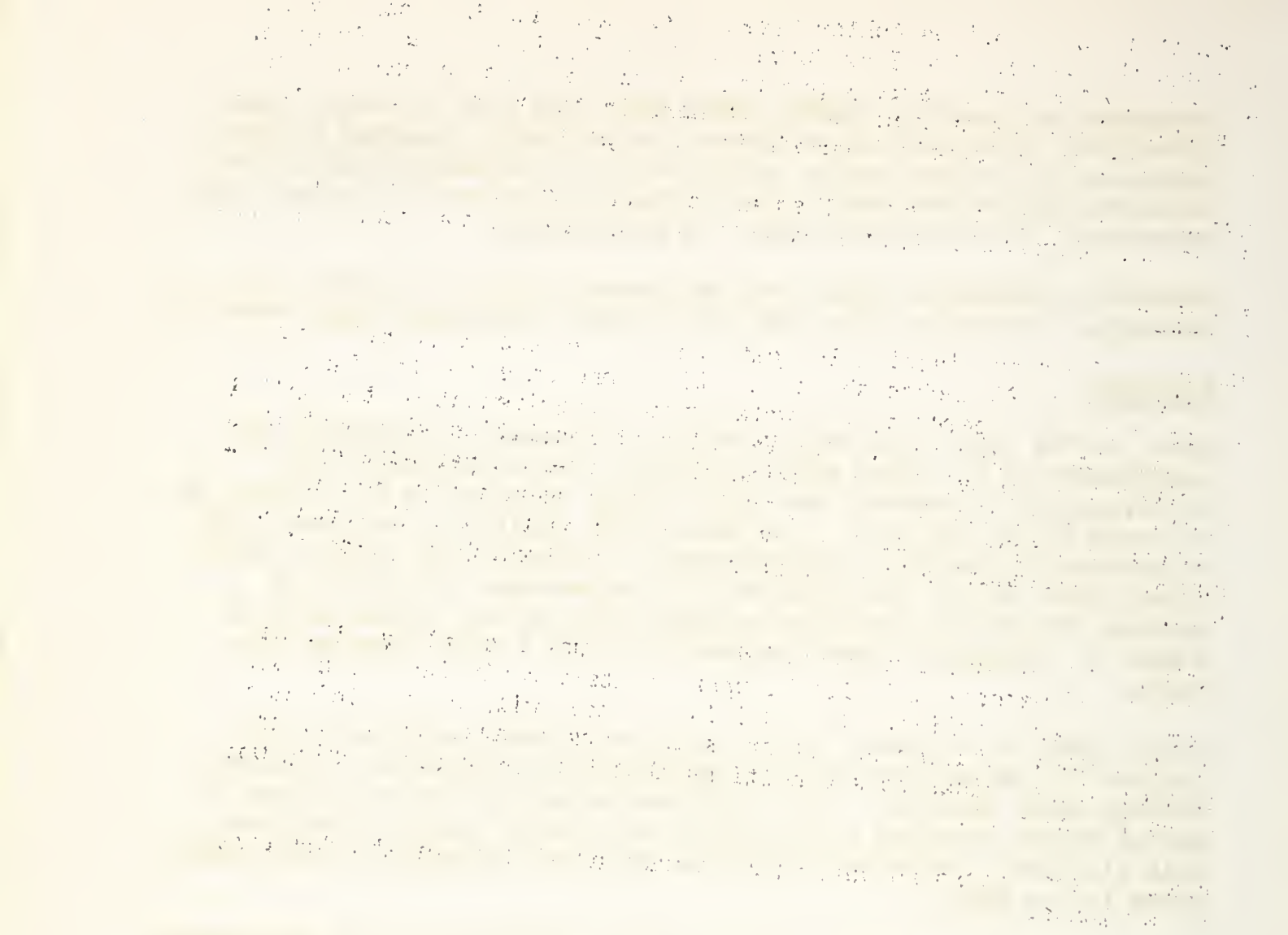
Excessive seepage and water loss are common along main canals and laterals. Correcting this loss will reduce late-season water shortages.

Findings

Based on the crop distribution pattern and average consumptive use requirement of 20 inches shown in Table 5 and an estimated farm efficiency of 55 percent, the water supply requirement of the unit is 36½ acre inches per acre. The Vernal unit facilities will meet this requirement by providing approximately 1 acre-foot per acre of additional water at the farm headgate for late-season irrigation in average or slightly less than average years on the 14,114 acres of Bureau of Reclamation Land Classes 1, 2, and 3 which comprise the unit.

During years of critical runoff deficiency water supplies will be improved 25 percent and will be approximately equivalent to present average water supplies. The additional water will be sufficient to permit normal maturing of all crops in years of average runoff and will eliminate disastrous conditions that have prevailed during worst years in the past.

Under present plans no water can be made available for the development of new lands.



Projected Agricultural Economy

Sources of Information

Past Studies

Numerous economic studies of irrigation developments have been relied upon for the economic and physical standards and the procedures used in this survey. Chief among them is the analysis of the economic potentials of the Weber Basin Reclamation project in Utah completed in 1951 by the Bureau of Reclamation, United States Department of Agriculture, and the Utah State Agricultural College.

Information for the Vernal unit area has been obtained by examining studies made by the Bureau of Reclamation in a survey of 57 tracts and farm operations for the 1955 crop year, conservation farm plans developed by the Soil Conservation Service, farm plans and farm budgets prepared by the Farmers Home Administration, farm record books kept under the Utah Cooperative Extension Service program, "Better Farming for Better Living", and from records maintained by the Bureau of Indian Affairs at Fort Duchesne.

Additional Field Work

The Bureau of Reclamation arranged a meeting at Vernal on August 15, 1956, for all agencies interested or having information on the Vernal unit area. Subcommittees were set up to discuss the various technical phases required as a basis for deriving an estimate of agricultural benefits.

The Field Party completed 30 additional farm worksheets selected to obtain more detail on certain items to supplement information obtained by the Bureau of Reclamation on 25 tracts of land, and to complete information on 5 new farms where the sample on Class 3 land was considered small. These worksheets supplied current information on farm size and cropping pattern for the entire farm; Bureau of Reclamation worksheets covered tracts but usually not farms. Inventories and useful life were obtained of livestock, equipment, buildings, and improvements. Local information about farm practices, tax data, and current prices was also obtained.

In addition, 13 soil conservation district conservation plans in the unit area were selected and reviewed. Crop yields, farm organization and conservation practices were studied to secure information on farm operations.

Present Agriculture

Farm Organization and Size

Ashley Valley farm operations vary in size from small part-time units to large enterprises consisting of several tracts. The farm ownership pattern does not reflect the size of farm operations. The 1950 Utah Census reported 947 farm operators in Uintah County. Approximately

300 farms [1] are located in the Vernal unit area of approximately 38,439 acres. Of this amount, rights-of-way and Vernal townsite occupy 1,731 acres leaving a net of 36,708 acres. Thus, the average size of farm is about 122 acres. The Bureau of Reclamation classified about 38 percent of this land as irrigable. On this percentage basis, 47 acres are in Classes 1, 2, and 3, 31 acres in Class 4 pasture land, and 44 acres in Class 6, or waste land. These averages do not show the size of full-time farms, as such, nor of part-time farms.

Because of markets, crop adaptability, and grazing resources, most of the farms depend upon livestock or livestock products for income.

The most intensive type of agriculture present in the unit area is dairying. Of 100 dairymen [2] 16 sold Grade A milk, 11 sold Grade B milk, and 73 produced Grade C milk in 1955. Most Grade C producers have small herds of dairy cattle. At present, cattlemen and sheepmen depend largely upon outside grazing during the summer and use the irrigated land as a winter feed base.

Irrigated crops consist of alfalfa hay, native hay and pasture, corn silage, barley, oats, and wheat.

Eighty-four operators, or 28 percent, of a total of 300 operators use outside land resources to augment the income from irrigated farm units (table 8). Livestock operators with permits on both national forest and land administered by the Bureau of Land Management have been considered as single permittees.

Table 8.--Public grazing permits held by farmers in the Vernal unit area

Item	Permittees	Permits
	Numbers	Numbers
Cattle:		
Forest Service	39	2,224
Bureau of Land Management	9	354
Total cattle:	48	2,578
Sheep:		
Forest Service	24	36,428
Bureau of Land Management	12	15,260
Total sheep:	36	51,688

1/ Reuss, Lawrence A. and Blanch, George T., "Utah's Land Resources". Utah Agr. Exp. Sta. and U.S. Dept. of Agr. Econ. Special Report 4.

2/ From records of Hi-Land and Arden Dairies which purchase most of the milk produced in the area.

Crop Adaptations

Irrigation is essential in the Vernal unit area for successful crop production. The growing season is not sufficiently long for some crops. Special or vegetable crops adapted to cool seasons are limited by distance to market. This area is adapted to general feed crops such as hay and grain, including corn for silage. Alfalfa utilizes by far the greatest acreage (approximately 37 percent). Corn silage is the only row crop of importance. Much of the area is used for pasture only due to soil, topography or irrigation water delivery.

Soils limit crop selection only in combination with other conditions. These conditions most generally are water table or topography. Many farms have wet lands adapted to pasture or hay grasses only. These same farms and others have steep lands that can be farmed only with close growing crops such as hay and pasture.

Some soils are shallow to gravel or have lime accumulations that affect some of the deeper rooted crops. Alfalfa can adapt its root system to these shallower soils but corn cannot. Small grains and pasture or hay grasses are well adapted to lands with shallow soil.

Soil Fertility

Crop rotations have not been regularly used within the area due to irregularity of water delivery. Alfalfa has been grown on the land longer than is consistent with good production. Low producing pastures have been retained for several years. Water has been diverted during the late season to corn at the expense of pasture or hay. More consistent water supplies will make it possible to maintain a rotation that will protect and improve the soil.

Fertilizers have been mostly produced on the farm. Soil improvement crops have consisted of rotation of alfalfa and pasture. The use of green manures has not been consistent enough to give maximum benefits but have helped maintain a fair level of fertility.

Commercial fertilizers have been used by some farmers for the past several years. More farmers are appraising the results and following the practice. The most common practice is the application of phosphate fertilizer on new seedings of alfalfa or pasture. Increased use of commercial fertilizer, particularly phosphate, can be expected when irrigation water delivery ceases to be the limiting factor of crop production.

Soil management, in relation to irrigated agriculture, is lagging behind some of our more progressive farming areas but is consistent with average areas. Many soils, particularly those classified as 2s by the Bureau of Reclamation, will respond to better soil management practices. When good soil management becomes general over the area, an increase in irrigation efficiency can be expected.

Some Important Economic Assumptions

This analysis is a long-time projection of the agricultural economy that might prevail in the Vernal unit area if late-season water is made available. These projections are based on certain important physical and economic assumptions. Both economic and non-economic factors may be different than those assumed.

Type of Agriculture

The Uintah Basin is not served by a railroad. This feature, in combination with distance to population centers, various physical features of the area, and other factors, favors a livestock economy. A basic assumption is that types and sizes of farms will be similar to those now prevailing in the area (variations will be noted later). It is further assumed that the markets for agricultural products will consume the goods produced in the area within the projected price structure.

Land Condition

Projected budgets are based largely on the present condition of the land. Lands to be served by the unit facilities are now virtually all under irrigation. Much of the development work has been performed. However, additional water and other factors will make it desirable to make further improvements. Assumed yields allow for the performance of small amounts of land improvement. These investments are entered in the budgets as costs.

Returns to Water

The income analysis is made on the basis of a full water supply. A marginal analysis in terms of an additional or supplemental water supply has been feasible only to a limited extent. A "with-without" summary in terms of farm income "associated" with additional water is presented later in the report.

The survey assumes that additional water will be used on presently-irrigated lands. Thus, the irrigation of permanent pastures and possible new land has not been analyzed as an alternative.

Price Levels and Relationships

The income analysis is based on "Agricultural Price and Cost Projections" developed by the United States Department of Agriculture. These projections were published in June 1956, for official use by United States Department of Agriculture agencies in benefit-cost and repayment-capacity analyses. The projected prices are based on "relatively high employment, a trend toward peace, continued population and economic growth, and a stable general price level".

The long-term projected index of prices received for all farm commodities is 235, base period 1910-14. A comparable index is 265 for prices paid, including interest, wages, and taxes.

A further notion about projected prices can be obtained by looking at specific prices used in the analysis and comparing them with prices of the past (table 9). Many cost items on the projected basis are similar to those paid in 1955. Prices received vary somewhat more in terms of the last several years. Generally, prices received for livestock under the projections appear more favorable than prices received for crops in terms of the recent past.

Table 9.- Some illustrative prices received and prices paid in Utah and the Vernal unit area, long-term projections and historical

Item	Projected Vernal	1955 Utah	1939-44 Utah
	Dollars	Dollars	Dollars
Alfalfa hay (baled)	23.00	23.00 1/	16.20 1/
Wheat	1.50	1.88	.96
Barley	1.10	1.02	.71
Beef cattle	16.50	14.10	8.80
Wool	.48	.46	.33
Butterfat (Grade A)	1.23 2/	4.05 3/	2.07 3/
Butterfat (Grade C)	.70 2/		
Farm wages - hour	1.00	1.00	.45
Tractor	2450.00	2500.00	1300.00

1/ All hay.
2/ Net above hauling to the farmer.
3/ Percent for all milk sold on a wholesale basis.

Technology

Assumptions concerning the development and adoption of machinery, improved practices, and other innovations are important to the analysis. They are also important to an evaluation of the projected prices.

Increased efficiency, the use of more machinery, and greater competition among persons doing custom work, for example, have been assumed.

Labor and machine inputs per unit (acre, head, etc.) are assumed to be substantially lower than those used in most similar analyses of the past. In some instances, this means greater investments and costs for machinery and less labor. Usually, it means lower per-unit cost of output. No doubt this assumption is inherent in the United States Department of Agriculture projected prices and costs.

The most marked reduction in labor requirements has been made for corn silage. The reduction comes about through the current practice of spraying for weeds. This practice eliminates hoeing and reduces cultivation to furrowing for irrigation. Labor requirements for dairy cattle have been reduced substantially as compared with results of many earlier studies. The earlier standards, when applied to 30- or 40-cow dairy herds were not feasible in some instances. On the other hand, many operators are caring for 30-cow herds and farming large acreages of land.

Another note of interest relates to projected prices and increased efficiency of custom-hire operations. Projected machinery and labor prices are higher than several other projections used previously and currently. But in some cases both current and projected custom-dollar rates are lower than they were even during the 1939-44 period. When projected custom rates are applied on an acre or head basis, the difference is even more marked. In effect, these factors improve the income prospects of the projected prices over what might be expected by looking at index numbers or by making percentage adjustments from historical bases of even 10 or 15 years ago.

Rate of Return on Investment

The rate of return that should be used in benefit analyses is open to question. The rate used here is 5 percent.

Return to Operator and Family Management and Labor

An opportunity-cost approach has been used as the basis of the return to management and labor. That is, an attempt is made to evaluate operator and family management and labor in the same manner as other resources.

In addition to return for management and labor, the farm family will have a return on its equity in the farm. Returns on owned investment and returns for management and for labor together must provide for cash living expenses, farm privileges (considered as farm income), a residence, savings, income tax, social security tax, and other living needs.

Depreciation

The straight-line method of depreciation is used. A 10 percent salvage value is assumed. Interest is calculated on the depreciated value which is 60 percent of new value for machinery and buildings.

Projected Agricultural Incomes

An estimate has been made of farm incomes expected with the proposed development of water. "Expected" rather than what "ought to be" is an important concept in this respect.

Methodology

The farm budget approach has been used. Typical farms were set up and net incomes derived on the basis of projected prices and other assumptions. These net incomes for individual farms are then aggregated on the basis of total acreages and water supply to derive an estimate of agricultural incomes expected from development of additional water for the Vernal unit area.

The residual approach is used to arrive at an average return to irrigation water. In other words, the total income on each farm is distributed among the various claimants of the income, with water being the last claimant.

The income analysis is made by Bureau of Reclamation land classes. The objective in this classification is to group soil and water conditions which are relatively homogeneous with respect to: (1) Productive capacity, (2) adaptability for crops and cropping systems, (3) development costs, such as clearing, leveling, farm irrigation systems, price of land in its condition before supplying irrigation water and other similar investment costs, and (4) costs of operation which are peculiar to the soil and water for given land areas.

Land classes of various productive capacity are intermixed in the Vernal unit area. Few, if any, irrigated farms in the area will be comprised entirely of a single land class. For analytical purposes, an assumption has been made of a single class for each representative farm.

Representative Sizes and Types of Farms

Detailed income analyses have been made of three types of farms (table 22). These types are dairy cattle, combination Grades A and C; beef cattle, range and fattening out calves; and dairy cattle, Grade C. The range livestock budgets include public grazing. Sheep is the main livestock enterprise omitted. It appears that returns from sheep operations currently are greater than beef, Grade-C dairying and general farming and are less than Grade-A dairying. The sheep enterprise is less established on irrigated land in the Vernal area than dairy and beef cattle.

The acreage of irrigable land in the synthetic farms ranges from 80 to 160 acres. The present average acreage of all farms, including part-time farms, is substantially less than this range. However, a large number of farms in the area are greater than these acreages. Also, the analysis is based on a concept of a full-time, family-operated farm. This latter assumption rules out small and large farms in the area.

Several types and sizes of farms have been developed for each land class. A composite farm has been derived for each group from several farms. These composite farms are used for summary purposes. They do not resemble any real farm as may the farms going into the composite.

The weighted average sizes of farms are 90, 112, and 151 acres for the three land classes, respectively. Assuming all farms within each group to contain an acreage equal to the particular weighted average, there would be 37, 51, and 34 farms, respectively, with an average of 116 acres of irrigable land. This calculation is based on 14,114 acres of irrigable land in the Bureau of Reclamation land classification. The irrigated productive land on the three land classes averages 85, 104, and 142 acres per farm with a project average of 108 acres of productive land per farm.

Larger farm acreages have been used in the budgets as the productive capacity of the soil declines. This practice is customarily applied in federal reclamation programs. It grows out of national policy on new projects of public land to give all settlers approximately equal financial opportunities.

Projected sizes and types of farms are based partly on present agricultural operations in the area. Data are available on operations and resources for about 65 farms. These data come from two sets of worksheets for individual farms--one set compiled by the Bureau of Reclamation and one set compiled by the United States Department of Agriculture.

The sample farms were selected in an effort to omit part-time farms. Thirty farms were included in the United States Department of Agriculture group (table 10). Seven farms of the thirty are dairy. These farms contained 160 acres of irrigated land of all classes. This acreage ranged from 56 to 390 acres. The dairy farms averaged 29 cows. All farms were Grade A dairies. One farmer had 80 beef cows; the other 6 had no beef animals. There were no sheep on these farms. Four of them contained a few chickens.

Ten range livestock farms in the group averaged 146 acres of irrigated land. All except one farmer in the group had public grazing permits. These permits averaged 70 head of cattle. All 10 farmers had both beef cows and ewes. Averages for all farms were 81 cows and 54 ewes. Only 2 farmers had 100 ewes or more. Four farmers had 100 or more beef cows. All farms included a few dairy cows.

The 13 general farms were diversified with respect to crops and livestock. Seven farms had a few dairy cows. None had beef cows. Four farms contained sheep averaging 17 ewes for all farms. Four farms had chickens with one commercial poultry farm of 750 chickens. These rural farms were smaller than the other two groups. They averaged 146 acres of irrigated land but had few public grazing privileges.

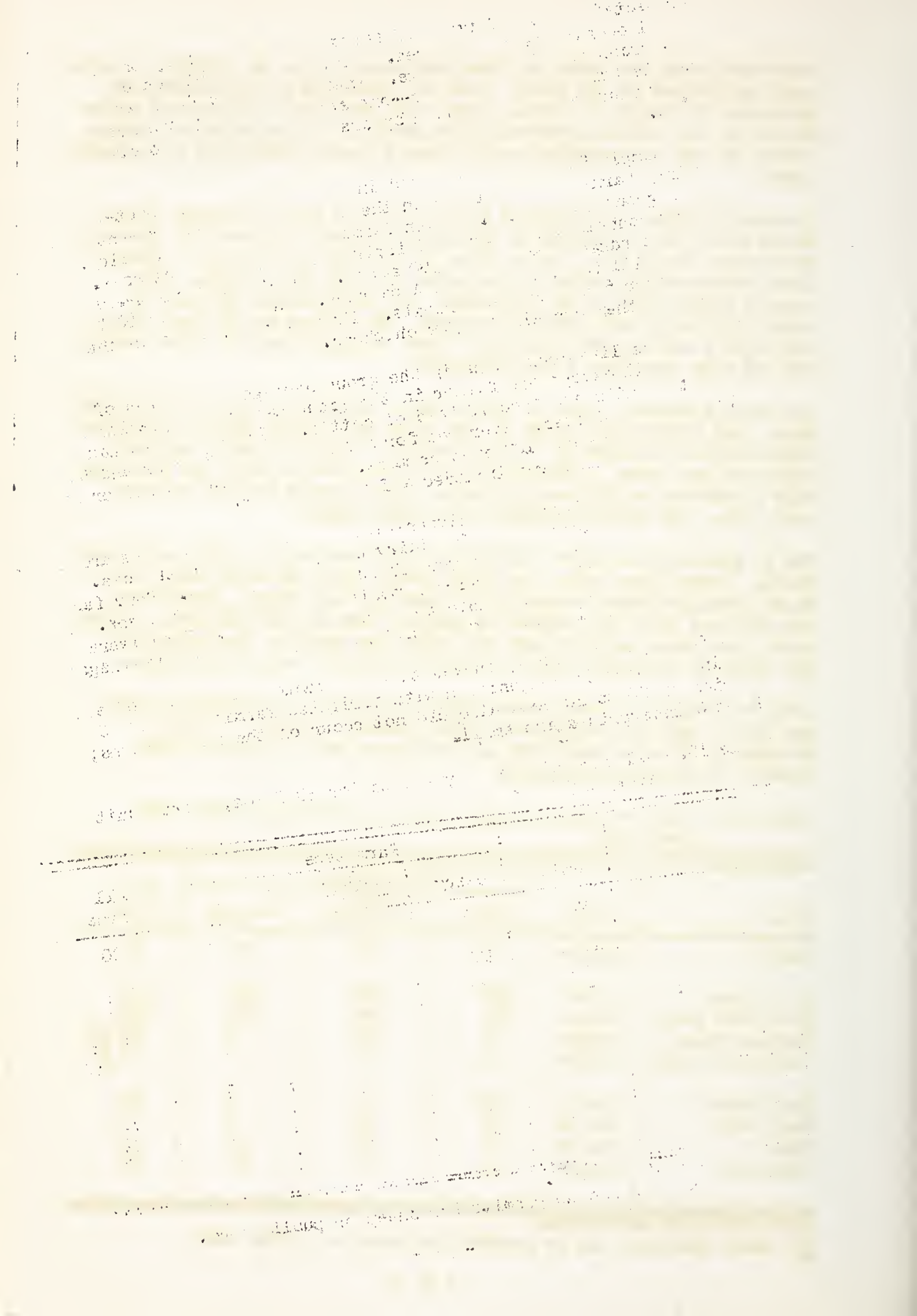
Data for these 30 farms, showed that few commercial flocks of sheep are in the area in conjunction with irrigated farming. Grade C dairies of 20 to 40 head also did not occur on the sample farms; Grade C enterprises are small.

Table 10.-- Selected size and type data for 30 farms, Vernal unit area, 1955

Item	Unit	Farm type: Dairy	Range livestock	General	All farms
Farms	Number	7	10	13	30
Total land	Acres	187	390	229	273
Irrigated land	Acres	160	146	146	149
Federal range	Cattle	0	70	3	25 1/
National forest	Cattle	0	70	2	25 1/
Dairy cows	Number	29	4	7	11
Beef cows	Number	11	81	6	32
Ewes	Number	0	54	32	32
Chickens	Number	44	49	72	58

Data from USDA worksheets.

1/ These operators had no permits for sheep on public land.



Cropping Programs Expected

Alfalfa hay, rotation pasture, corn for silage, and small grains--mostly barley and wheat--are expected to be the main crops (table 11). These crops now constitute the leading ones. The projected farm budgets emphasize corn for silage to a greater extent than now is produced in the area. But the profitability and increased planting of corn silage is becoming more evident in the area and in the State of Utah. "Other hay" is not included in the budgets.

Table 11.-Proportion of crop acreage in various crops on 30 farms by farm type, Vernal unit area, 1955

Crop	Dairy	Range livestock	General
	Percent	Percent	Percent
Alfalfa hay	42	32	36
Other hay	2	30	12
Irrigated pasture	33	22	36
Corn for silage	11	5	3
Wheat	1	4	3
Barley	10	4	6
Oats	1	3	4
Total	100	100	100

Livestock Enterprises Expected

Grade A dairies set up include from 27 to 36 cows and replacement stock. The replacement stock constitutes one-fourth heifer over a year and one-fourth heifer under a year for each cow. Thirty cows on a Grade A basis appear to be a full-time job for an operator and his family on the basis of labor requirements assumed.

The beef enterprise centers around 80 breeding cows. Combination of irrigated land and public range use characterizes these farms. The sheep enterprise, not considered specifically, is assumed to be represented by a combination of other farm types to the extent that it will exist. Total public grazing resources have been assumed to be used by cattle in determining farm numbers on irrigated land. Consideration of private range has not been feasible. But this does not appear to be a serious problem from the standpoint of analysis.

A Grade C dairy based on 40 milch cows has been included (table 22). To a degree, they represent those farms with small numbers of several kinds of livestock. As noted earlier, under the projected prices it appears unlikely that Grade C dairies will be important. Grade A dairy farmers are assumed to market 35 percent of the milk as Grade C. Other Grade C milk producers are small-scale enterprises or general farms with a few milch cows.

Farm Practices Expected

On most projected budgets, custom work is assumed for baling and raking hay and straw, combining grain, and chopping corn for silage. In most instances, additional labor is hired for harvesting alfalfa and corn. The main exceptions are on beef cattle farms where a chopper is owned for harvesting alfalfa and corn and on the larger-acreage Grade C dairies where some additional equipment is owned. Thus, it will be observed that a wide range exists in the budgets with respect to hours of use of the farm tractor (table 22).

All fertilizer produced on the farm is applied on the land. Based on a general need for 4 tons of manure per acre plowed, fertilizer deficiencies are made up with commercial fertilizer. The assumed crop yields can be achieved with this standard of fertilizer application.

Some improved soil management is assumed as a basis for crop yields used for a stable, productive agriculture. These practices include shorter rotations of hay and irrigated pasture. More fertilizer is applied. Greater irrigation efficiency is assumed.

All forage crops, including corn for silage, are fed on the farm. Livestock numbers are determined essentially by the available forage. The rotations yield some surplus of small grains, especially on dairy farms. Thus, some grain is sold off the farms. On the other hand, beef-feeding operations require purchase of small grains on the smaller acreages.

Production Rates

Livestock--Dairy cows produce 300 lbs. of butterfat per year on the farms used in the analysis. Feed and other standards have been set in an effort to be consistent with a 300-pound level.

The beef cattle enterprise is based on an operation of fattening out calves. The annual output of beef is assumed as 632 pounds per breeding cow. Calves are weaned in the fall at weights of 350 pounds for heifers and 400 pounds for steers. After 200 days of feeding, they are sold as choice grade at weights of 750 and 800 pounds, respectively.

Crops--Three basic projected yield levels are used (table 12). These levels represent production rates on Bureau of Reclamation Land Classes 1, 2, and 3. More than three significant classes of soil productivity may occur in the area in terms of income potentials. The three levels of yields are used, however. The farm budgets are worked through to a net income to land and water with a full water supply.

These three levels were established at a group meeting in Vernal, Utah in August 1956. Personnel of the Bureau of Reclamation, Utah State Agricultural College, and U. S. Department of Agriculture were in attendance at the meeting.

Table 12.- Basic crop yield levels on irrigated land projected for the Vernal unit area

Crop	Unit	Yield level by Bureau of Reclamation land classes		
		1	2	3
Alfalfa hay	Ton	4.2	3.8	3.0
Rotation pasture	AUM	8.0	7.0	5.0
Corn silage	Ton	17.0	14.0	10.0
Wheat	Bu.	40.0	35.0	30.0
Barley	Bu.	55.0	50.0	40.0
Oats	Bu.	60.0	55.0	50.0

These yields appear conservative in terms of a long-time expectancy. They provide for some improvement in practices and technology. On the income side, however, many projected inputs represent greater efficiency than has been assumed usually in similar studies. Lower yields and improved efficiency apparently are offsetting in terms of income.

Crop yields in 1955 on a sample of 30 farms are shown in Table 13. The sample is small and covers all land classes. But the yields support the notion that water supply in inadequate at the present time.

Table 13.-Average crop yields on 30 farms by farm types, Vernal unit area, 1955

Farm type	Alfalfa hay	Corn silage	Wheat	Barley	Oats
Beef	4.3	17.1	30.5	46.6	60.5
Dairy	2.6	15.4	19.0	39.3	--
General	1.8	11.4	21.5	25.8	20.0
Average	2.8	14.9	25.4	35.2	35.6

Relations between the three projected levels of crop yields are significant. The differential between levels 1 and 2 is considerably less than the differential between levels 2 and 3 (tables 12 and 14). As expected, the differentials vary in degree according to crop.

Considerable differences exist between projected yield levels and forage crops in terms of feed production (table 15). Corn silage has a wide advantage over alfalfa and pasture from the standpoint of feed production. This advantage apparently holds also from an income standpoint (table 22). The advantage becomes less marked as the productive capacity of the soil declines.

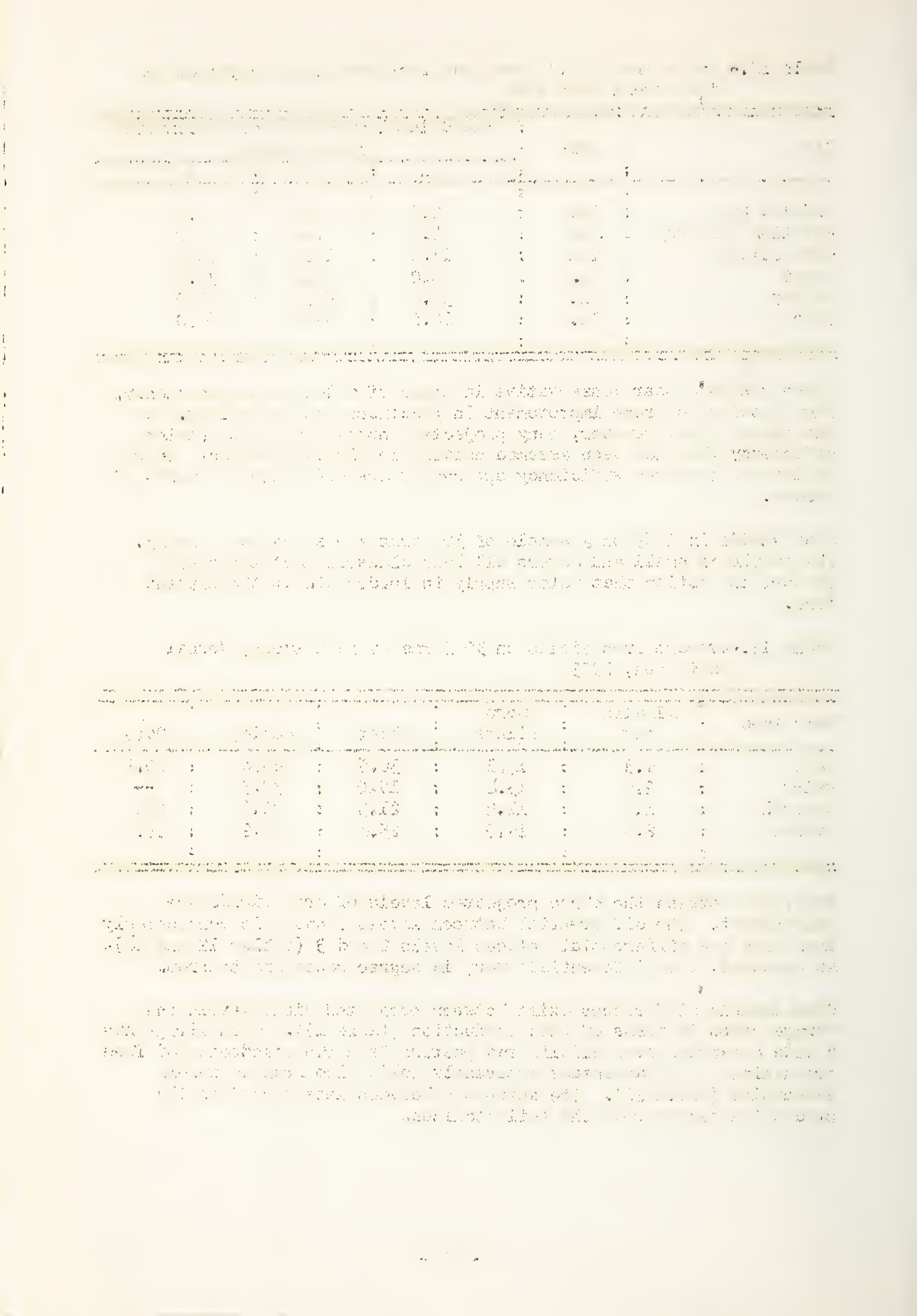


Table 14.-Relation between projected levels of crop yields with level 1 as the base, Vernal unit area

Crop	Yield level		
	1	2	3
	Percent	Percent	Percent
Alfalfa	100	90	71
Pasture	100	88	62
Corn silage	100	82	59
Wheat	100	88	75
Barley	100	91	73
Oats	100	92	83

Table 15.-Net feed production for forage crops and projected yield levels with alfalfa as a base, Vernal unit area

Crop	Yield level		
	1	2	3
	Percent	Percent	Percent
Alfalfa	100	100	100
Rotation pasture	89	85	77
Corn silage	137	123	111

Capital Investment Except Land and Water

At the projected price level, capital investment for buildings, improvements, equipment, livestock, and feeds ranges from $21,481 to $29,939 for the various farm budgets (table 22). Livestock is the largest single item in this group. As noted elsewhere, buildings and equipment are depreciated to 60 percent of new cost for investment purposes. Details of investment items are shown in Tables 16 to 18.

Other Input Rates

Projected feed, labor, machinery, and other farm production inputs are shown in Tables 19 to 21. Both quantities and prices appear in these tables. The 1956 United States Department of Agriculture projected prices are used in all price measurements.

Table 16.-Investment values for livestock, Vernal unit area. (1956 U.S. Department of Agriculture Projected Prices)

Item	Value
	Dollars
Livestock	
Dairy cows	250
Dairy heifers, more than 1 yr.	125
Dairy heifers, less than 1 yr.	50
Beef cows	125
Beef heifers, more than 1 yr.	100
Beef heifers, less than 1 yr.	50
Beef bulls	250

Table 17.-New costs, repairs and depreciation of farm buildings and improvements, Vernal unit area. (1956 U. S. Department of Agriculture Projected Prices)

	New cost	Annual repairs	Annual depreciation
	Dollars	Percent 1/	Percent 1/
Dairy barn and milk room 2/	2700	1.8	3.6
Dairy shed and corral 2/	2500	1.2	3.6
Granary (500 bu.)	500	1.2	3.6
Machine shed	1500	1.2	3.6
Pit silo	5.00 per ton	0.6	3.6
Domestic water system 3/	850	1.2	3.6
Fences	1.50 per rod	1.2	3.6

1/ Percentage of new cost.
2/ Constructed to meet standards of Grade A milk production.
3/ Farm share, 50 percent

Land taxes are based on a levy of 45 mills. Assessed values used are $50, $40, and $30 per acre for land at the three yield levels, respectively. These projections amount to tax costs per acre of $2.25, $1.80, and $1.35.

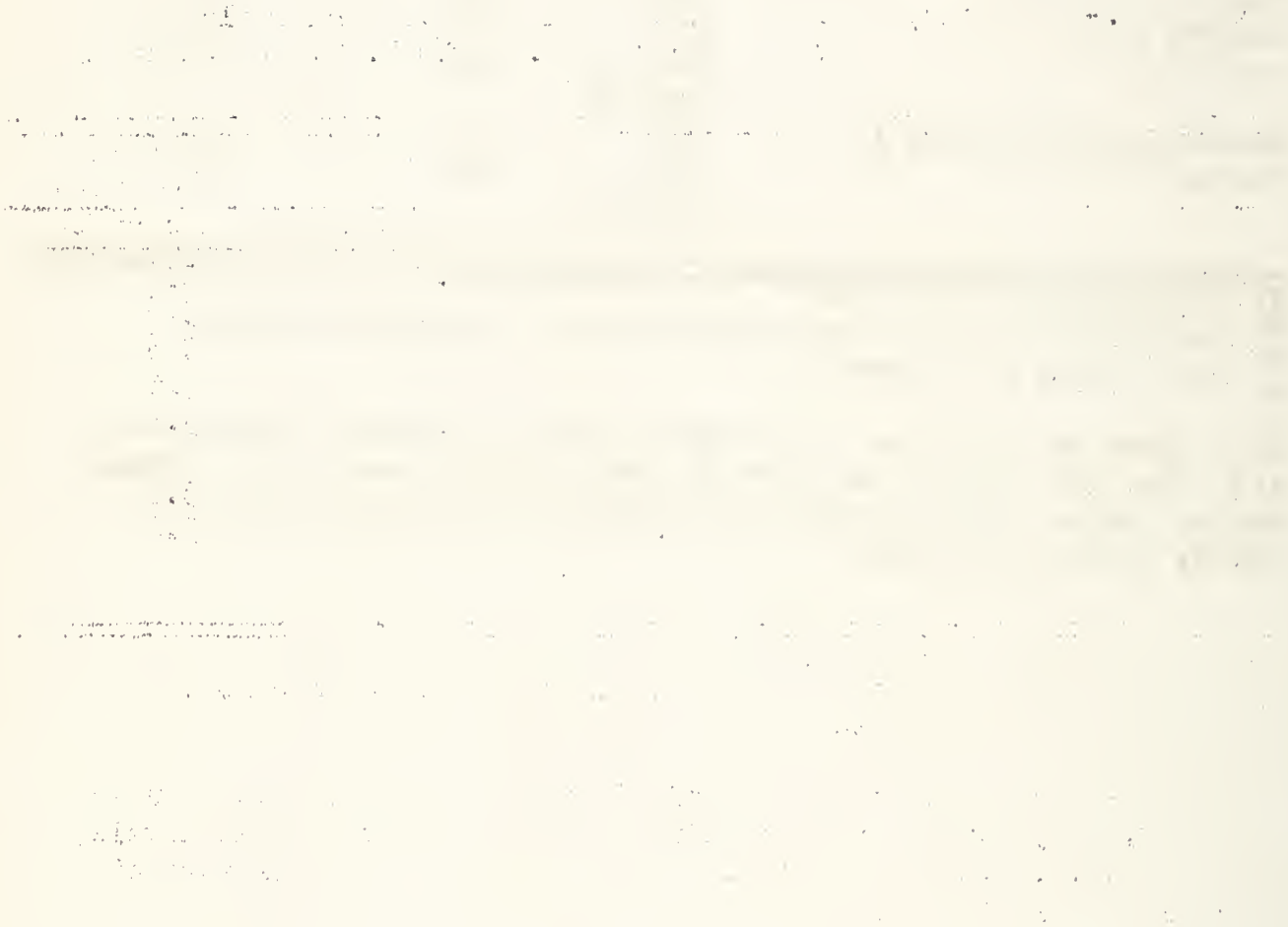


Table 18.-Estimated new cost, repairs and service life of farm equipment, Vernal unit area. (1956 U. S. Department of Agriculture projected prices)

Item	Description	Cost	Annual repairs 1/	Service life 2/
		Dollars	Percent	Years
Tractor		2,450	14¢ hour	10
Truck	1 ton, dump-hoist	2,450	5.0	10
Plow	2 x 4" tumble	549	3.0	16
Grain drill	10'	314 3/	2.0	16
Corn planter	2 row	113 3/	2.0	16
Harrow	3 section	196	1.0	15
Elevator-w/motor	Hay and grain	350 3/	3.0	20
Sprayer	Barrels and pump	74 3/	2.0	10
Corrugator	Shovels	10	0.0	10
Tool bar	Attachment bars	88	1.0	10
Feed grinder	10"	98	3.0	15
Mower	7'	323	3.0	10
Rake	Custom hire	-	-	-
Manure spreader	75 bu.	274 3/	3.0	15
Land leveler	Eversman	196 3/	2.0	20
Ditcher & diker		108 3/	2.0	20
Manure loader		279 3/	3.0	15
Baler	Custom hire	-	-	-
Milking machine	2 unit	425	6.0	15
Heater	30 gal.	80	1.0	18
Milk tank	300 gal.	2,450	2.0	30
Electric fence control		25	5.0	11
Low boy trailer		98	1.0	20
Other equipment used on larger farms				
Baler PTO	"55"	2,360	5.0	12
Chopper PTO	w/corn head	1,960	3.0	10
Wagons (2)	w/attachments	500	1.0	20
Combine	7' PTO	1,970	3.0	10
Rake	Side delivery 7'	473	3.0	15
Small tools 4/				

1/ Percentage of new cost.
2/ Straight-line depreciation and 10 percent of salvage value.
3/ 50 percent ownership.
4/ 5 percent of new cost except tractor and truck.

Table 19.-Livestock feed requirements, Vernal unit area

Item	Total animal units 1/	Total digestible nutrients	Source		
			Forage 2/	Grain 3/	Other
	Number	Number	TDN	TDN	TDN
Dairy cow (1200 lbs.)	1.35	6,921	6,471	450	0
Dairy heifers over 1 year	.74	3,800	3,800	0	-
Dairy heifers under 1 year	.37	1,900	1,487	300	113 4/
Beef cow 5/ (1000 lbs.)	.90	4,599 6/	4,599	-	-
Beef heifers over 1 year	.50	2,555 6/	2,555	-	-
Beef bulls	.90	4,599 6/	4,599	-	-
Fattening steers	.70	3,577	2,077	1,500	-
Fattening heifers	.70	3,577	2,077	1,500	-

1/ One animal unit equals 5,110 TDN or 14 TDN per day.
2/ Alfalfa equivalent. Assumes 50 percent TDN and 10 percent loss in harvesting and feeding. This is 420 TDN per AUM plus 10 percent loss.
3/ Total digestible nutrients calculated as 75 percent.
4/ 700 lbs. whole milk or equivalent.
5/ Includes cow and calf.
6/ 50 percent of feed from forest permit and field residue.

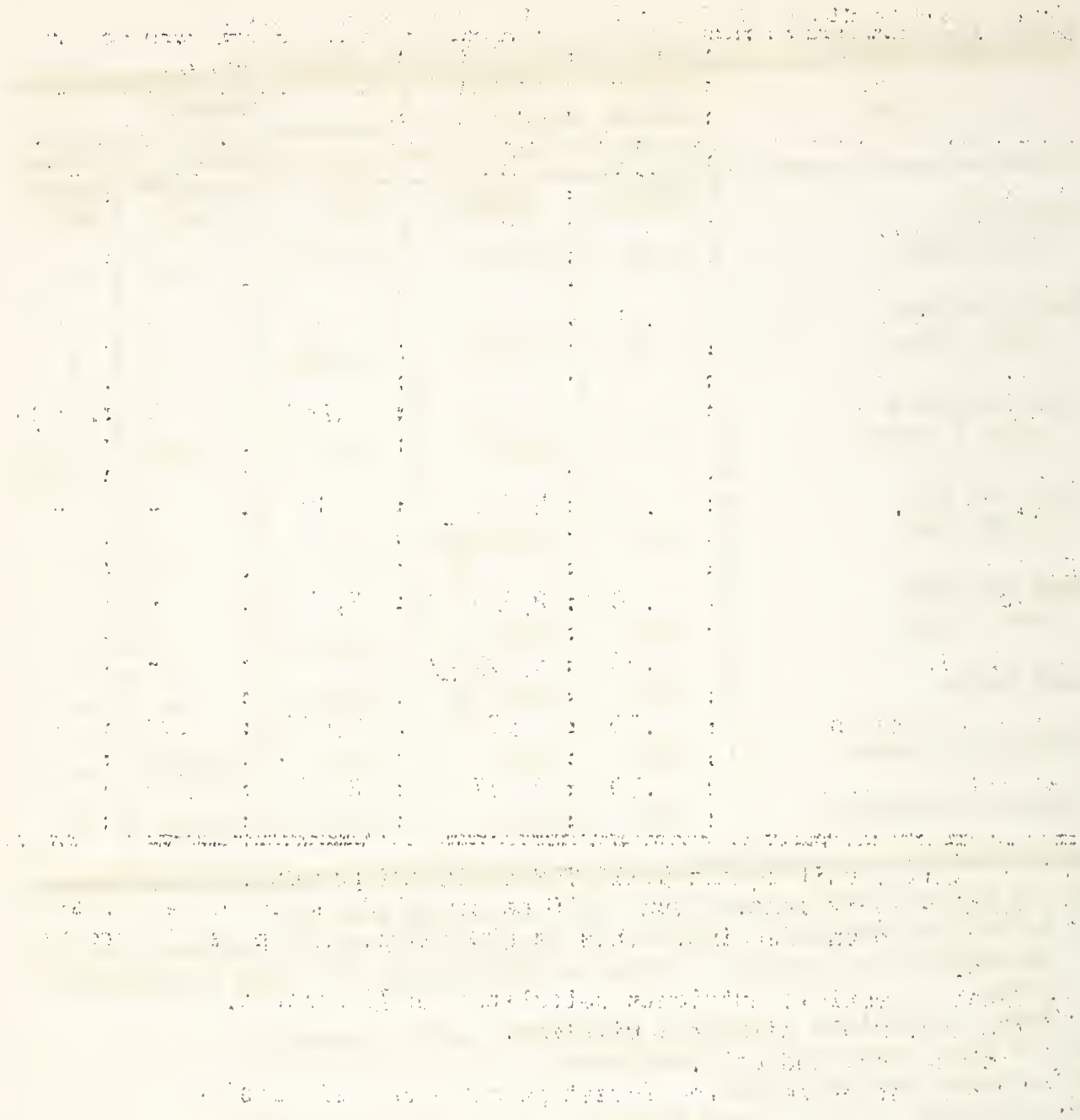


Table 20.- Total projected man and tractor hours per unit of crops and livestock, Vernal unit area 1/

	Man work	Tractor work
	Hours	Hours
Crops:		
Alfalfa 2/	15.5 3/	8.2
Rotation pasture 2/	8.1	1.5
Corn silage	19.8 3/	13.3
Small grains	12.0	6.8
Straw	4.5 3/	3.5
Livestock:		
Dairy cows, Grade A milk 4/	96.0	-
Beef cows 4/	11.0	-
Fattening steers 5/	10.0	-
Fattening heifers 5/	10.0	-
Miscellaneous: 6/		
Overhead	5 percent of total crop and livestock labor	
Hauling manure	0.4 hour per ton of manure	
Fence repair	4.0 hours per 100 rods of fence	
Machinery repair	0.5 hour per $100 of machinery inventory	

1/ Adjustments were made for yield variations from these hours.
2/ Plowing one-fourth acreage each year is included in time requirements of crops planted on newly broken land.
3/ 4 tons, 17 tons, and 1 ton, respectively.
4/ Includes replacement stock. Based on 30 dairy cows and 80 beef cows.
5/ 200 days feeding period.
6/ Man-hours only. Miscellaneous tractor hours equal man-hours for overhead and hauling manure.

Table 21.- Estimated prices paid for goods and services used in production, Vernal unit area (1956 U. S. Department of Agriculture projected prices)

Item	Unit	Price
		Dollars
Seed:		
Alfalfa	Pound	0.30
Pasture	Pound	0.30
Corn	Pound	0.17
Fuel, oil, and grease:		
Tractor	Hour	0.41
Truck	Mile	0.029
Labor	Hour	1.00
Custom and contract hire:		
Baling and raking:		
Hay	Ton	5.25
Straw	Ton	7.50
Combining grain	Acre	6.00
Chopping corn	Hour	8.00
Hauling corn	Hour	3.00
Veterinary	Per cow	3.00
Artificial insemination	Cow and heifer over 1 year	7.00
Cow death loss	Per cow	7.50

Net Farm Incomes

Net farm income is defined in this instance as a return for operator and family management and labor, all investment including land and irrigation water, and annual expenses related directly to land and water. Details of individual farm budgets can be examined in Table 22.

The weighted average farm receipts for three levels of crop production are $10,513, $10,605, and $10,640, respectively. Corresponding annual farm expenses without interest average $4,786, $4,709, and $5,697 per farm. These results give net farm incomes of $5,727, $5,896, and $4,943 by yield levels.

Composite farm acreages are 90, 112, and 151 acres for the respective yield levels. Irrigated land averages 85, 104, and 142 acres per farm, respectively. Wide variations in net farm incomes occur among farms because of size, soils, cropping pattern, and kinds of livestock.

Table 22.-Summary of Selected Income, Size and Organizational Items From Projected Farm Budgets, Vernal Unit Area (USDA 1956 Price Projections)

Item		Yield Level 1						Yield Level 2					Yield Level 3				
		Grade A Dairy	Grade A Dairy	Beef Cattle	Beef Cattle	Grade C Dairy	Weighted Average	Grade A Dairy	Grade A Dairy	Grade C Dairy	Beef Cattle	Weighted Average	Grade A Dairy	Grade A Dairy	Grade C Dairy	Beef Cattle	Weighted Average
Farm Number		1	1A	1B	1C	1D	-	2	2A	2B	2C	-	3	3A	3B	3C	-
Weighting		25	15	25	15	20	100	20	20	10	50	100	10	10	20	60	100
Total irrigable land:	Acre:	80	100	80	100	100	90	100	100	120	120	112	110	120	160	160	151
Alfalfa and pasture	Acre:	48	56	45	40	66	51	60	56	80	55	59	70	68	105	60	71
Corn silage	Acre:	12	15	10	15	12	12	14	10	10	11	11	13	18	20	20	19
Small grains	Acre:	16	23	20	40	16	22	20	28	20	44	34	20	27	25	70	52
Farmstead, waste, etc.	Acre:	4	6	5	5	6	5	6	6	10	10	8	7	7	10	10	9
Dairy or beef cows	Number:	30	36	80	80	39	[illegible]	32	30	40	80	[illegible]	27	29	41	80	[illegible]
Farm tractor use	Hour:	360	449	783	853	540	589	430	470	597	1,016	748	450	548	818	1,472	1,147
Total productive labor:1/	Day:	428	525	279	320	542	412	472	458	551	335	409	428	473	648	414	468
Operator and family	Day:	405	492	266	301	493	385	441	424	512	315	382	396	434	524	375	413
Investment:	Dollar:	22,165	24,958	24,867	25,999	23,824	24,166	23,260	22,429	23,788	25,648	24,341	21,481	22,369	24,741	29,939	27,296
Farm buildings & improvements	Dollar:	5,562	6,135	3,342	3,930	5,550	4,846	5,970	5,790	5,508	3,858	4,832	5,814	6,000	5,910	4,074	4,808
Machinery and equipment	Dollar:	6,750	6,750	6,888	6,888	5,256	6,506	6,750	6,750	5,256	6,888	6,670	6,750	6,750	5,256	10,310	8,587
Livestock	Dollar:	8,775	10,575	13,050	13,050	11,500	11,300	9,400	8,725	11,750	13,050	11,325	7,975	8,475	12,000	13,050	11,875
Feeds and supplies	Dollar:	1,078	1,498	1,587	2,131	1,518	1,514	1,140	1,164	1,274	1,852	1,514	942	1,144	1,575	2,505	2,026
Total farm expenses:2/	Dollar:	4,486	5,343	4,820	4,117	5,204	4,786	4,871	5,001	5,539	4,362	4,709	4,724	5,271	6,933	5,518	5,697
Depreciation and repairs	Dollar:	1,516	1,563	1,496	1,551	1,426	1,505	1,548	1,541	1,426	1,574	1,547	1,541	1,568	1,494	2,243	1,956
Contract and hired labor	Dollar:	1,034	1,534	375	660	1,502	982	1,253	1,401	1,751	693	1,052	1,163	1,454	2,797	877	1,347
Land taxes	Dollar:	180	225	180	225	225	202	180	180	216	216	202	148	162	216	216	204
Other	Dollar:	1,756	2,021	2,769	1,681	2,051	2,097	1,890	1,879	2,146	1,879	1,908	1,872	2,087	2,426	2,182	2,190
Total receipts:	Dollar:	10,703	13,142	9,596	10,068	9,786	10,513	11,527	11,287	10,245	10,036	10,605	9,706	10,636	10,413	10,871	10,640
Crop sales	Dollar:	462	782	160	632	231	414	520	1,011	480	600	654	405	678	428	1,435	1,055
Livestock sales	Dollar:	950	1,215	9,336	9,336	1,440	4,442	1,090	960	1,440	9,336	5,222	925	955	1,450	9,336	6,080
Livestock products	Dollar:	9,087	10,941	-	-	7,945	5,502	9,713	9,112	8,155	-	4,580	8,172	8,799	8,365	-	3,370
Farm privileges	Dollar:	204	204	100	100	170	155	204	204	170	100	149	204	204	170	100	135
Net farm income	Dollar:	6,217	7,799	4,776	5,951	4,582	5,727	6,656	6,286	4,706	5,674	5,896	4,982	5,365	3,480	5,353	4,943
Interest on above investment	Dollar:	1,108	1,248	1,243	1,300	1,191	1,208	1,163	1,121	1,189	1,282	1,217	1,074	1,118	1,237	1,497	1,365
Net income3/	Dollar:	5,109	6,551	3,533	4,651	3,391	4,519	5,493	5,165	3,517	4,392	4,679	3,908	4,247	2,243	3,856	3,578

1/ Ten-hour days
2/ Excluding interest
3/ Return to operator and family for labor and management and to land and water

7-N-17085

LOCATION MAP

Vernal Project Watershed

UINTAH COUNTY

R. 20 E.

R. 21 E.

R. 22 E.

R. 19 E.

T. 1 S.

T. 2 S.

T. 3 S.

T. 4 S.

T. 5 S.

DAGGETT CO.

UINTAH CO.

ASHLEY NATIONAL FOREST

Brush

OAK PARK CANAL

OAK PARK RESERVOIR

Taylor Mtn. El. 10,102

Trout Creek Peak El. 10,509

Trout Cr.

Ashley Cr.

Ashley Cr.

Black Canyon

Sims Peak El. 10,520

South Fork

LONG PARK RESERVOIR

El. 9,966

El. 11,126

TWIN LAKES RESERVOIR

Hacking Lake

Leidy Peak El. 12,013

Goose Lakes

Marsh Peak El. 12,176

Chimney Rock Lake

Hades Canyon

Horn Fork

Dry Fork

Lake Mtn. El. 9,000

Deadman Lake

Twin Lakes

El. 10,119

El. 9,966

Red Mtn. El. 7,?

Little Mtn. El. 6622

Willow Cr.

Ashley Cr.

GREEN RIVER

109° 30'

109° 45'

40° 45'

40° 30'

LEGEND

- Watershed Boundary
- Project Boundary
- Sub Watershed Boundary
- National Forest Land
- Private Land
- State Land
- Public Domain Land

LAND STATUS
VERNAL UNIT, CENTRAL UTAH PROJECT
UINTAH COUNTY, UTAH

OCTOBER, 1956

1 0 1 2 3

SCALE IN MILES

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

7-S-17059-N

Interest on Investment

Interest on investment other than land and water is $1,208, $1,217, and $1,365 for the three yield levels or composite farms (table 22). If these interest amounts are deducted, returns for operator and family labor and management and for all land and water costs under the assumed full water supply conditions are $4,519, $4,679, and $3,578, respectively, for the three composite farms.

Land Investment and Costs

Land to be included in the unit has been developed and has been farmed for many years. Usual costs of the development period on new land have been met. These costs include application of water to newly leveled and cleared land, stabilization of the soil to heavy water application, and soil fertility improvement.

Projected total investments, including the price of raw land, have been estimated at $100, $90, and $60 per acre for three land classes, respectively. The values assume purchase of raw land and development of it to approximately the present state of development in the Vernal unit area. Interest on this investment is $5, $4.50, and $3 per acre for the three classes of land, or an average of $4.08 per acre for all land.

Reference is made here to an earlier section in the report on land improvement costs. Only small additional costs are considered necessary to utilize the proposed additional irrigation water in achieving the projected yields used in the farm budgets. The earlier section was aimed primarily at emphasizing that additional improvement of land in the Vernal unit area would be profitable for many farmers. This frequently would result in production rates greater than those projected in this report or in lower costs per unit of production. Neither the increased production or the costs of additional land improvement has been included in the budget analysis. If this were done, a higher level of management would be assumed. The residual left for irrigation water may remain about the same since a larger deduction would be made for operator and family management and labor.

Return to Operator and Family Management and Labor

The residual approach requires an allocation of part of the farm income to management and labor furnished by the operator and his family. This allocation has given rise to some controversy, mainly because of two factors. First, management and family labor are not priced in the market as are most factors of production. Secondly, points of view have varied widely on irrigation projects as to the approach to this problem.

As noted earlier, this analysis is oriented to an allocation on the basis of alternative opportunities to farmers. This point of view differs substantially from a view oriented to maximizing farm numbers and farming opportunities. No doubt the latter view has substance in connection with new irrigation projects on public land. It seems to have little, if any, merit in an established irrigated area such as the Vernal unit area.

The question of unearned increments from public irrigation development frequently enters into consideration of this problem. Whether they exist and the extent to which they occur have not been established. The accuracy with which income projections are made is important to this problem. Farmers can be overcharged as well as undercharged for irrigation water.

The labor standard applied in the projected budgets is 3,000 hours of operator labor and 1,500 hours of family labor plus the necessary management. Variations from the 450 ten-hour day standard occur on the projected farms because of differences in types and sizes (table 22). A farmer with a dairy enterprise, for example, distributes his labor over the year more than can a farmer with cash-crop enterprises.

Original investigation of this problem has not been feasible. Reliance is placed on previous work, mainly the conclusions of the study of the Weber Basin Project in Utah and investigations which served as a basis for those conclusions. 1/ That study arrived at an allocation to labor and management of $1,800 at 1939-44 adjusted prices and $2,600 at the U. S. Department of Agriculture 1952 projected prices (215 indexes, parity 100). This latter conversion was made using indexes of prices paid for living items used in family maintenance. These incomes gave the operator a farm hired wage rate for his labor and a somewhat smaller return for family labor based on a man-equivalent.

1/ Fuhriman, W.U., Blanch, G.T., and Stewart, C.E., An Economic Analysis of the Agricultural Potentials of the Weber Basin Reclamation Project, Utah. Utah Agricultural Experiment Station Special Report No. 7, December 1952.

The method used in the Weber Basin Study results in an allocation to labor and management of $3,186 (table 23). The amount allocated to labor and management has great significance in terms of return to irrigation water and repayment allocations.

An allocation of $3,186 amounts to $0.71 per hour on the basis of 4,500 hours as compared with the hired wage rate of $1 per hour used in the projected budgets. An allocation for labor and management of $3,100 has been used in this study.

Table 23.- Indexes and incomes to management and labor of the operator and his family

Period	Family living index 1/	Percent of 1939-44	Income
			Dollars
1939-44	144	100	1,800
1947-49	244	169	3,042
1955	273	190	3,420
Projections:			
215/215	210 3/	146	2,600
235/250 2/	240 3/	167	3,006
235/265	255 3/	177	3,186
Vernal adjusted	255	172	3,100

1/ Commodities bought for family maintenance.
2/ Modified 1956 USDA Projection proposed by Bureau of Reclamation.
3/ Estimated on basis of all prices paid by farmers.

Net Income Available for Family Management and Labor and Irrigation Water

The weighted average returns after deducting interest on all investment are $4,069, $4,175, and $3,125 per farm at the three yield levels (table 24). These incomes are available for family living expenses and payments for irrigation water, including operation and maintenance.

If family and operator labor and management were allowed $3,100 per farm, the residual would be $969, $1,075, and $25 per farm at the three yield levels. On the basis of total irrigable land, these returns are $10.77, $9.60, and $0.17 per acre, respectively. Note is made that these returns should not be applied directly to repayment classes of the Bureau of Reclamation.

Table 24.- Projected average net farm incomes and returns to family labor and management and irrigation water, by yield levels, Vernal unit

Yield level	Net farm income	Interest on investment		Income to labor, management, and irrigation water	
		Land	Other	Total	Per acre 1/
	Dollars	Dollars	Dollars	Dollars	Dollars
1	5,727	450	1,208	4,069	45.21
2	5,896	504	1,217	4,175	37.28
3	4,943	453	1,365	3,125	20.70

1/ Based on weighted average farm sizes of 90, 112, and 151 acres per farm, respectively.

Findings

Net farm incomes based on the projected budgets with the proposed additional irrigation water point to an improved agricultural economy in the Vernal unit. The average net farm incomes would be well over $5,000 per farm. After allocating interest on investment and land charges, around $4,000 would remain for operator and family labor and for investment in irrigation water and payment of related water costs.

Direct Agricultural Benefits

A primary purpose of investigations summarized in the report to this point has been to develop a foundation for estimating direct agricultural benefits from the proposed development of supplemental irrigation water on the Vernal unit. Before pursuing the analysis further, a definition of terms, a statement of some underlying concepts, and a statement of assumptions underlying the estimate of direct benefits seem desirable.

Direct agricultural benefits are defined as the value of farm production expected with project development in excess of farm production anticipated without project development less the value of additional farm inputs or associated costs required. The concepts and assumptions on the specific composition of "additional farm inputs or associated costs," as used in this report, are outlined below.

Two basic assumptions relate to the national and local economy: (1) That the national economy will operate at essentially full employment for the period of analysis. Price projections, for

example, are premised partly on this assumption. This means that many alternative opportunities would exist in the national economy for use of resources, including the labor and skills of farm operators and family members. It means also that farm prices received and paid are higher than they would be with unemployment. (2) That, because of relatively fixed and enduring local obstacles to economic adjustments, some under employment of resources may exist on Vernal unit farms without additional water for a relatively long period. Partly, this means that some increased employment of local resources may be attributable to additional irrigation water, depending on the present farm size and organization.

Yield Increase with Additional Water

Estimates have been made that the following yields would be achieved with the present water supply and with a full water supply:

Crop	Unit	With full water supply	With present water supply	Difference
Alfalfa	Ton	3.8	2.9	0.9
Rotation pasture	AUM	7.0	4.0	3.0
Corn silage	Ton	14.0	14.0	0.0
Barley	Bu.	50.0	40.0	10.0
Wheat	Bu.	35.0	30.0	5.0

Net Incomes Associated with Increased Crop Yields

The first comparison is based on income differences associated directly with crop yield changes. The net increase averages $9.85 per acre on a 100-acre farm under land class 2 yields (table 25).

Table 25.- Net crop income changes associated with additional irrigation water on land class 2, Vernal unit

Crop	Yield difference	Area	Gross income	Expenses 1/	Net increase
		Acres	Dollars	Dollars	Dollars
Alfalfa	0.9 2/	56	20.70	8.12	12.58
Corn silage	0.0	10	0.00	0.00	0.00
Barley	10.0	14	11.00	2.35	8.65
Wheat	5.0	14	7.50	2.10	5.40
Straw	0.3	(28)	4.50	3.60	0.90
Total	-	94	16.42	6.57	9.85

1/ Does not include additional O & M costs which were estimated at $1.23 per acre.
2/ Rotation pasture is assumed at the same net effect as alfalfa.

The gross income added in this instance would be $16.42 per acre. Net additional expenses would be $6.57 per acre, leaving the net increase of $9.85 per acre. The added expenses are mostly operating costs. An increased interest cost of $0.25 per acre is included for estimated additional land improvement. Increased operation and maintenance costs for water must be paid out of the $9.85; these costs are estimated tentatively at $1.23 per acre. Of course, water construction costs allocated to irrigation repayment would have to be paid out of this amount also. Additional operator and family labor needed for the larger yields is valued as an expense at $0.75 per hour.

Comparison of "With-Without" Incomes for Projected Budgets

This comparison has been made for three farm budgets (table 26). The three farm types are Grade-A dairy, Grade-C dairy, and beef cattle. Land class 2 yields are used. The assumption is made that these yields and farms represent projected incomes associated with additional water for the entire Vernal unit. This assumption is based partly on the indication that similar crop yield differentials would be experienced on other classes of land.

The three farm types are viewed as representing several kinds and variations of types and sizes. Grade-C dairy farms, in particular, probably will not exist to the extent assumed. It is used to represent several other types of farms and should not be viewed in terms of projecting that 15 percent of the farms will be Grade-C dairies.

Table 26.- A comparison of net incomes for three projected budgets with and without additional irrigation water, Vernal unit

Item	Unit	Grade-A dairy		Grade-C dairy		Beef cattle	
		Without project	With project	Without project	With project	Without project	With project
Weighting	Percent	-	35	-	15	-	50
Total irrigated land	Acres	94	94	110	110	110	110
Operator and family labor	Days	367	424	415	512	243	315
Receipts	Dollars	8,680	11,287	7,280	10,245	7,970	10,036
Expenses 1/	Dollars	4,325	5,001	4,606	5,539	4,166	4,363
Net farm income	Dollars	4,355	6,286	2,674	4,706	3,804	5,673
Interest on investment 2/	Dollars	1,920	2,021	2,010	2,269	2,187	2,362
Net returns	Dollars	2,435	4,265	664	2,437	1,617	3,311
Difference	Dollars	-	1,830	-	1,773	-	1,694
Extra family labor 3/	Dollars	-	428	-	728	-	548
Increased income total	Dollars	-	1,402	-	1,045	-	1,146
Increased income per acre, irrigated 4/	Dollars	-	14.91	-	9.50	-	10.42

1/ O & M and interest not included.
2/ Five percent.
3/ Seventy-five cents per hour.
4/ Includes increased O & M.

The increases in net income with additional water are $14.91 per acre of productive land for the Grade-A dairy, $9.50 per acre for the Grade-C dairy, and $10.42 per acre for the beef cattle budget (table 26). An estimated weighted average for the three budgets is $11.85 per acre of cropland. Increased O & M costs--estimated earlier at $1.23 per acre--are included in this average. The average net increase estimated on the basis of cropping pattern and yields was $9.85 per acre (table 25). The method of using projected budgets, as compared with cropping pattern and yields, introduces other resources, such as livestock and larger amounts of all resources. This has the effect of a greater increase in net income.

Findings

An estimate is made that the maximum direct agricultural benefits annually would be around $11.85 per acre of productive land, including additional O & M. On this basis, the increase in incomes associated with a supplemental supply of water from the proposed project of 13,500 acres of productive land is estimated at $160,000 annually.

Change in numbers of pages in final draft. There is no page 50.

CHAPTER III

IMPACT OF THE VERNAL UNIT UPON THE ADMINISTRATION, MANAGEMENT AND USE OF NATIONAL FOREST LANDS AND RESOURCES

This report considers the impact of the Vernal unit of the Central Utah Participating Project on the Ashley National Forest.

It is aimed at determining what facilities, resources and uses are affected and at evaluating these effects.

The watersheds tributary to this unit involves approximately 133,000 acres within the Ashley National Forest boundary. About 61 acres of this is cultivated private land (a patented homestead) situated on Dry Fork Creek; the balance is national forest land. These watersheds include the Ashley Creek drainage, the Dry Fork Creek drainage, part of the Brush Creek drainage above the Oaks Park Reservoir and the canal from the reservoir into Ashley Creek.

Present Status - Current Use

Range Management

About 13,000 sheep are permitted to graze on all or parts of 14 sheep allotments within these watersheds for various seasons of about two months each between the dates June 16 and September 15. In addition, about 20 bands of sheep presently cross to and from their allotments elsewhere on the Ashley and Wasatch National Forests over the sheep trails on these watersheds.

About 800 cattle are also permitted to graze on all or parts of four cattle allotments on these watersheds for about a four-month season from June 1 to October 5.

There are approximately 50,000 acres within these range allotments that are classed in "poor" and "very poor" condition with a downtrend in both soil and vegetation. The Forest Service objective in managing all range lands is to keep soil in place and to maintain a healthy plant cover for watershed protection and sustained livestock production. Livestock adjustments are necessary on some of these areas to attain this objective and to bring about at least a "fair" condition class with an uptrend in both the vegetation and soil resource.

Special Uses

The Oaks Park Reservoir and Canal are operated by the Ashley Valley Reservoir Company under a special-use permit issued June 28, 1937. The canal from the reservoir is a transmountain diversion from the Brush Creek drainage to the Ashley Creek drainage. The water is transported in a canal until it reaches the top of the ridge where it enters the Ashley Creek drainage. From this point it is dumped down a draw to meander from the ridge top divide down the mountain into Ashley Creek proper. For about a half mile, the canal water has cut a gully channel on the mountainside that, in some places, is 75 feet wide and 15 feet deep. The bottom of this channel appears to be a soft conglomerate that is still cutting in many places.

Other Resource Uses

There are numerous other uses of national forest resources on the watershed, including timber, recreation and wildlife, but the unit will have no significant effect on these uses.

Stanaker Reservoir will be built approximately 6 miles south of the national forest boundary. It will provide for suitable fishing water near the town of Vernal, Utah. Recreational and sanitary facilities are planned to accommodate an estimated 10,000 annual visitor-days. The necessary improvements may be developed and maintained as a state, county or city endeavor.

Findings

As far as can be foreseen at this time, the Vernal unit of the Central Utah project will not impair any existing service or facility on forest lands.

CHAPTER IV

THE RELATIONSHIP OF WATERSHED CONDITIONS TO THE VERNAL UNIT

Watershed conditions and hazards covered in this report are quite common to most western irrigation projects. Usually they do not materially affect the feasibility of a project but they may have significant effects on project life.

Improvement of watershed conditions will not only lengthen project life but will also reduce operating difficulties, maintenance expense and help to alleviate local problems.

These conditions are pointed out so that local, state and federal agencies, which deal with watershed lands, and land owners who live in the flood plain, can orient their regular and special programs to the eventual solution of these problems.

Location and Size

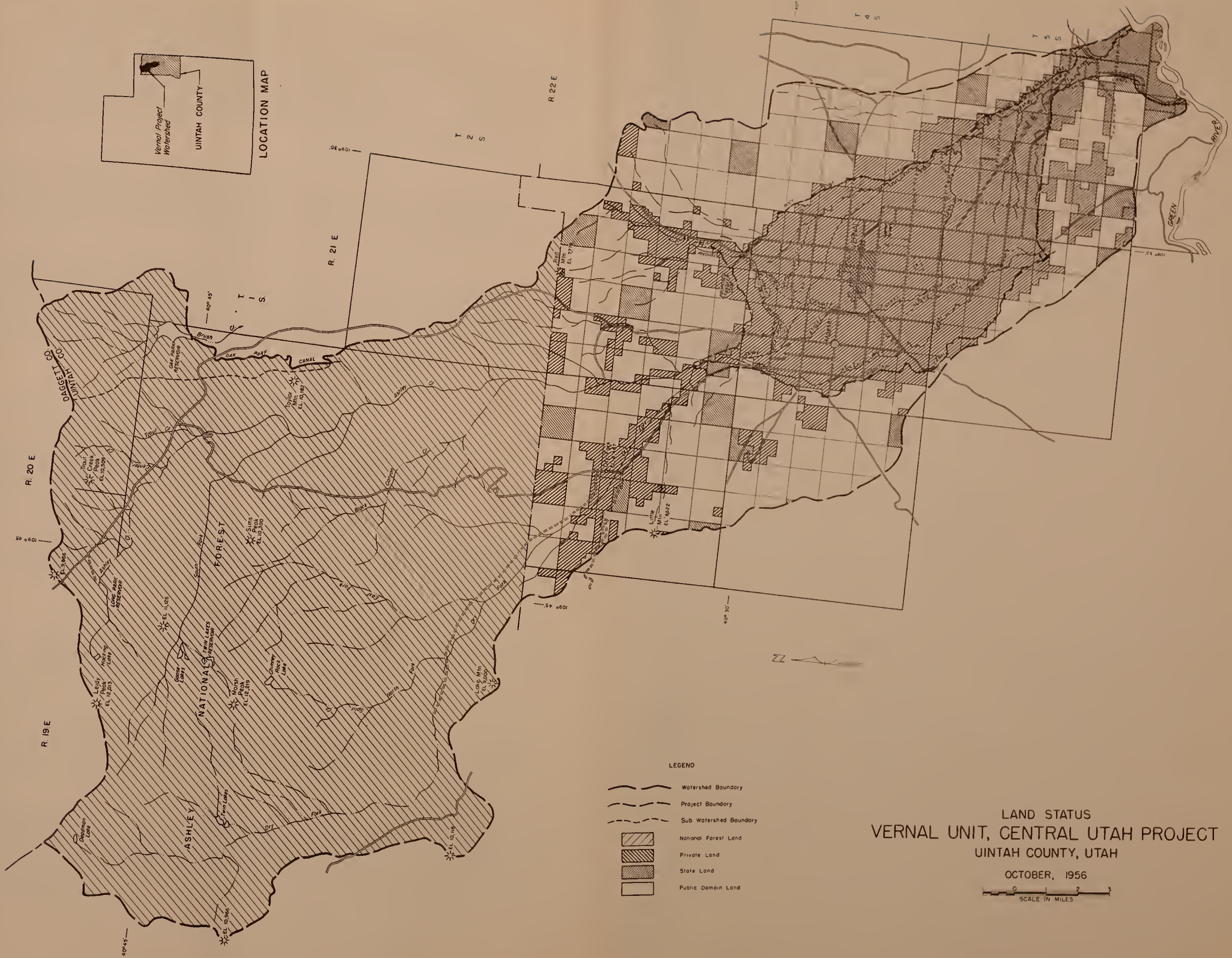
The Vernal unit watershed area covers approximately 262,500 acres of land and includes the irrigated and other lands lying in the valley and flood plain area.

Watershed Conditions

The following table outlines the condition of plant cover on national forest lands in the watershed.

Table 27.- Condition of plant cover - National forest lands

Principal vegetative type	Plant cover conditions (acre)				
	Good	Fair	Poor	Very poor	Totals
National forest land:					
Conifer	38,000	40,000	9,800		87,800
Aspen		2,000	2,500		4,500
Woodland (Juniper)				8,200	8,200
Grass		2,300	10,800	2,000	15,100
Desert Shrub (Sage)			6,700	3,000	9,700
Barren			6,500	1,200	7,700
Totals	38,000	44,300	36,300	14,400	133,000
Condition class by drainage:					
Ashley Creek	19,000	22,200	16,600	6,500	64,300
Dry Fork Creek	14,000	21,500	16,100	7,700	59,300
Brush Creek (Above Oaks Park Reservoir and Canal)	5,000	1,500	2,700	200	9,400
Totals	38,000	45,200	35,400	14,400	133,000



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7-S-17059-N

The lands in poor and very poor condition are losing soil in varying amounts. Sheet erosion is moderate on lands in poor condition. Various stages of gully erosion are in evidence on certain areas in very poor condition. Although downstream sediment damage is not serious, some of the eroded soil is reaching streams and is being carried as a sediment load. There is no evidence of destructive floods in the past from national forest land; however, due to depleted plant cover, some potential flood-source areas exist that could greatly increase the current sediment load.

State-owned and Bureau of Land Management-administered lands, located in the lower reaches of the watershed, consist almost entirely of sagebrush and/or juniper vegetative types. Some canyon bottoms at higher elevations contain scattered Ponderosa pine with associated grass and browse species.

In the juniper type ground cover is very sparse; generally speaking, 5 to 10 percent. Grass species occur rarely and are of low vigor. Browse species other than sage are nearly non-existent. In the sage type, ground cover is somewhat better primarily because of greater litter cover. Both types are subject to sheet erosion.

Ownership and Status

Land ownership in the watershed is as follows:

National Forest	133,000 acres - 50%
Bureau of Land Management	61,260 acres - 24%
Private Land	60,240 acres - 23%
State of Utah	8,000 acres - 3%

National forest, Bureau of Land Management and state lands are generally used for grazing, woodland and/or wildlife. Over half of the private lands are cultivated.

Watershed Problems

The flow of Ashley Creek is very irregular and has varied over a period of 30 years (1925-1955) from a low of 20 second feet to a high of 3,500 second feet. Most high water flows occur from snowmelt during the spring months.

Floodwaters on Ashley Creek cause some damage to irrigation diversion dams, canals, roads, and bridges. They also cause over-flow damage to adjacent agricultural lands, streambank erosion, and stream channel changes.

Sediment damage to irrigation distribution systems, resulting from silt-laden irrigation waters, is in evidence. Loss of crop production due to involuntary deferment of irrigation from sediment-clogged ditches or inferior quality of sediments coming from watershed lands is also a problem.

LOCATION MAP

Vernal Project Watershed

UINTAH COUNTY

R. 20 E.

R. 21 E.

R 22 E

R. 19 E.

T 2 S

T 3 S

T 4 S

T 5 S

DAGGETT CO.

UINTAH CO.

FOREST

NATIONAL

ASHLEY

VERNAL

Maeser

Brush

OAK PARK CANAL

OAK PARK RESERVOIR

Reseed 200 A

Reseed 1000 A

Reseed 4000 A

Reseed 3000 A

Taylor Mtn EL. 10,182

Red Mtn EL. 7278

Trout Creek Peak EL 10,509

Sims Peak EL 10,300

Marsh Peak EL 12,219

Leidy Peak EL 12,013

Little Mtn EL 8622

Lake Mtn EL 7,000

EL 10,116

EL 10,966

EL 11,126

EL 9,866

Dry Fork EL 6,467

Ashley Creek

Trout Creek

South Fork

Dry Fork

Block Canyon

Ashley Fork

Long Park Reservoir

Twin Lakes Reservoir

Twin Lakes

Goose Lakes

Hacking Lake

Deadman Lake

Chimney Rock Lake

Proposed Stream Channel

Proposed Spring Canal

Rock Point Canal

Ashley Canal

Central Canal

Highline Canal

Jensen Canal

Green River

Utah Road

Indian Trail

Forest Trail

LEGEND

- Watershed Boundary
- Project Boundary
- Sub Watershed Boundary
- Forest Boundary
- Gully Stabilization
- Road Erosion Control
- Proposed Fencing

WATERSHED TREATMENT MAP

VERNAL UNIT, CENTRAL UTAH PROJECT

UINTAH COUNTY, UTAH

NOVEMBER, 1956

SCALE IN MILES

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

7-S-17088-N

Watershed Protection and Flood Prevention Needs

Land Treatment on Private Land

Since most of the privately owned land in the watershed is located in or near the lower end of the watershed and is largely irrigated land, it does not present an erosion hazard and does not contribute substantial amounts of floodwater or sediment.

Land Treatment on Federal and Other Public Land

National Forest Land

Treatment of critical sediment-source areas within the Ashley National Forest would reduce sedimentation of the reservoir. (See watershed treatment map for locations) An estimate of needed treatment is as follows:

Treatment	Est. Amount
Reseeding	8,200 acres
Gully stabilization	4 miles
Fencing	47 miles
Roadside erosion control	4 miles

The Forest Service objective in management of range lands is to keep soil in place and to maintain a healthy plant cover for watershed protection and to sustain livestock production. Livestock adjustments are necessary on some of these areas to obtain this objective and to bring about at least a "fair" condition class with an upward trend in both the vegetation and soil resource condition.

State of Utah and Bureau of Land Management Lands

State of Utah and Bureau of Land Management lands are located in the lower reaches of the watershed and surround the private land located in the bottom of Ashley Valley. Grazing of these lands is for winter and spring-fall use. State lands are interspersed with the Bureau of Land Management lands and are not fenced separately, consequently they are managed together. Permittees on the Bureau of Land Management lands likewise have grazing permits for the state lands.

Watershed treatment recommended for these lands includes better grazing management accompanied by fencing, stock water developments and, in some cases, reseeding. Generally speaking, remnants of Galletta and Indian Ricegrass are present in the area and natural revegetation under utilization reduction may re-establish the species which are most adaptable to the natural environment. Some reseeding with Crested wheatgrass has been successful in small localized areas.

In locations where surface runoff becomes channelized and flood flows are causing damage to irrigation facilities, they can be controlled by means of mechanical structures such as over-shots, siphons, gully plugs, and small desilting or debris basins.

Grasses and forbs are depleted from livestock use. The foothill area serves as deer winter range, and browse receives heavy dual use both by livestock and game. Corrective livestock management is necessary, although this alone may not be the complete solution. The use by wildlife on browse must be recognized in all consideration.

Fire Protection

The Vernal watershed lies within the State of Utah's Basin Cooperative Fire Protection District and its organization and facilities are adequate for present conditions. Increased activity due to the construction of the reservoir, however, will call for some intensification of fire protection. This will include an additional fire guard for three months of the year plus fire fighting and communication equipment. An average annual cost of $1200 will probably cover this item.

Flood Prevention Structural Measures

Existing lakes and small storage reservoirs in the mountains tend to decrease flood peaks from snowmelt runoff on the Ashley Creek drainage. Due to the topography, general nature, and past flood history of the watershed, large flood control measures are not thought to be needed.

Improved management of watershed lands plus related measures such as fencing, reseeding, etc., rather than large structural measures will yield better and longer lasting results in the improvement of watershed conditions and the reduction of flood and sediment damage.

Irrigation Aspects

Two major drainage areas intersect the canal system and threaten the interruption of water deliveries and damage to the canals. These are the Coal Mine Basin Wash which intersects the Highline Canal in Section 7 and the LaPoint Road Wash which intersects the Highline Canal in Section 18, both in T4S, R21E. These washes have each discharged floodwater flows in recent years and have overtopped the canal. Problems from these two drainages can be handled by regular ditch operation and maintenance. Elsewhere, damages from side-wash water are limited.

Occasional rains of cloudburst intensities occur throughout the area and result in local damages to the irrigation systems. These storms are so erratic in nature and so haphazard in occurence that no major structural measures appear to be needed.

Anticipated Benefits

Installation of land treatment and flood prevention measures mentioned above will improve plant cover, increase soil stability, and decrease erosion. They will also provide off-site benefits by reducing sediment in irrigation water and by decreasing threat of floods to agricultural lands and facilities along Ashley Creek.

Improvement of vegetative cover on the watershed lands will reduce operation and maintenance costs as well as lengthen the useful life of the reservoir and related facilities.

Findings

Remedial measures such as indicated above and finally determined by more detailed consideration, need be installed in the watershed above the Vernal unit area to help assure its successful operation. Means and assistance should be provided the land-administering agencies and private operators of range and forest lands so they can accelerate installation of the needed watershed improvements to provide the needed protection.

CHAPTER V

REGULAR ACTIVITIES OF THE UNITED STATES DEPARTMENT OF AGRICULTURE PARTICULARLY AFFECTED BY THE VERNAL UNIT

Introduction

The United States Department of Agriculture and the Utah Agricultural College are presently carrying out agricultural activities in the Vernal unit area under their regular programs.

Although the unit development is limited to the furnishing of additional water supplies for presently-irrigated lands, there will be a substantial increase in agricultural activity in the Vernal unit area. Because of this increased activity, regular programs of the departmental agencies should be accelerated.

Agricultural Education and Information

The Utah Cooperative Extension Service maintains an office at Vernal. The services of a resident extension agent, assistant extension agent, home demonstration agent plus numerous non-resident specialists are available to farmers in the unit area. Additional information-education services will be required. This is particularly true in connection with an expanded dairy and livestock industry. Additional information and education in connection with better irrigation water management and pasture management will also be needed.

Technical Services

The Vernal unit lies entirely within the Uintah Basin Soil Conservation District. To furnish technical assistance to this district, the Soil Conservation Service has established an office at Vernal which is staffed with a work unit conservationist and an engineering aid. Additional soils, engineering, agronomy, and other specialist assistance is also available from other Soil Conservation Service offices at Roosevelt and Price.

Additional technical services and on-site assistance from Soil Conservation Service technicians will be required as additional dependable water supplies are furnished to unit lands. This assistance will be required in connection with field layout for land leveling, location of farm irrigation ditches, improved irrigation distribution systems, improved water management, and improved pastures and pasture management.

Some lands in the unit area will, in some years, still be short of a full water supply after the unit is developed. This stresses the need for establishment of additional snow courses in the watershed so that farmers may avail themselves of water supply forecast information to help them select suitable crops in the low-water years.

Farm Financing

The Farmers Home Administration has an office in Vernal with a county supervisor for Uintah County. In the past, loans have been made for water facility projects, establishment of conservation measures, and for purchase of farms in the unit area. Farm ownership loans have been somewhat limited because of short irrigation water supplies and small size of farm units. With additional water supplies and an increase in application of soil and water conservation measures, it is expected that there will be an increased demand for farm financing.

Cost-Sharing for Conservation Measures

The Uintah County ASC Committee has been active in promoting a sound cost-sharing program for the establishment of conservation measures in Uintah County. Roughly one-third to one-half of present county allocations has been spent within the unit area.

With increased agricultural activity, the need for additional cost-sharing funds to establish needed conservation measures becomes apparent. Farmers in the unit area are expected to place additional emphasis on the establishment of conservation measures incident to water management with a corresponding increase in sign-up for cost-sharing.

Additional technical assistance to service this activity will be needed.

Research Needs

A comprehensive report covering all research needs for the entire Colorado River Storage Project area will be developed by representatives of the U. S. Department of Agriculture research agencies, state agricultural colleges, and experiment stations as these studies proceed on additional participating projects.

In addition to these general research needs, it is felt that there is a need for the following specific research investigations on the Vernal Unit of the Central Utah Project:

1. Determine amounts of nitrogen fertilizer and level of organic matter needed for sustained high production and quality of adapted irrigated forage and grain crops.

2. Determine adapted species, methods of water application, fertilizer requirements for sustained high production, and proper cutting time and proper grazing management of wet meadows and pasture lands.

3. Study of irrigation methods and water application best adapted for efficient distribution and maximum utilization of available water supplies.

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